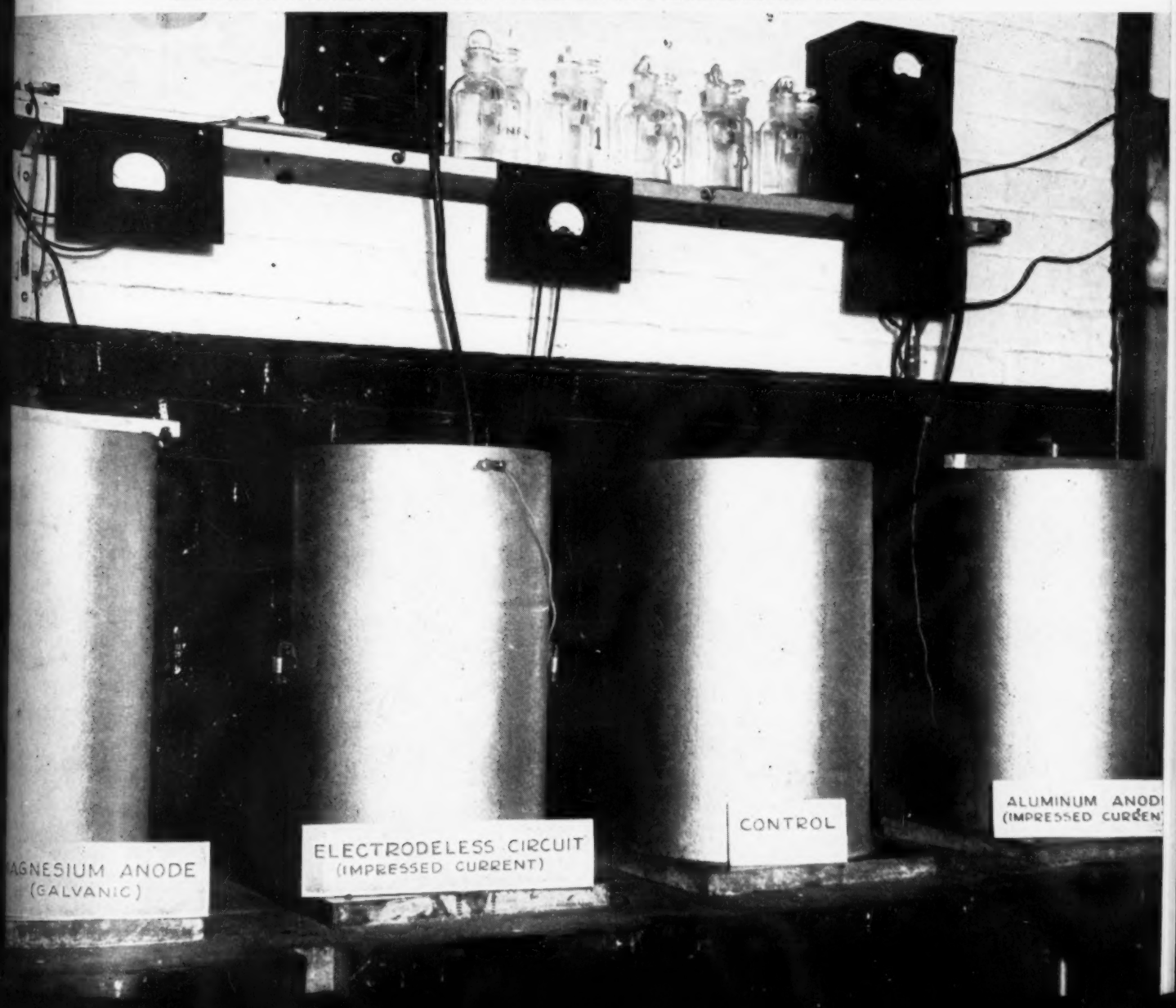
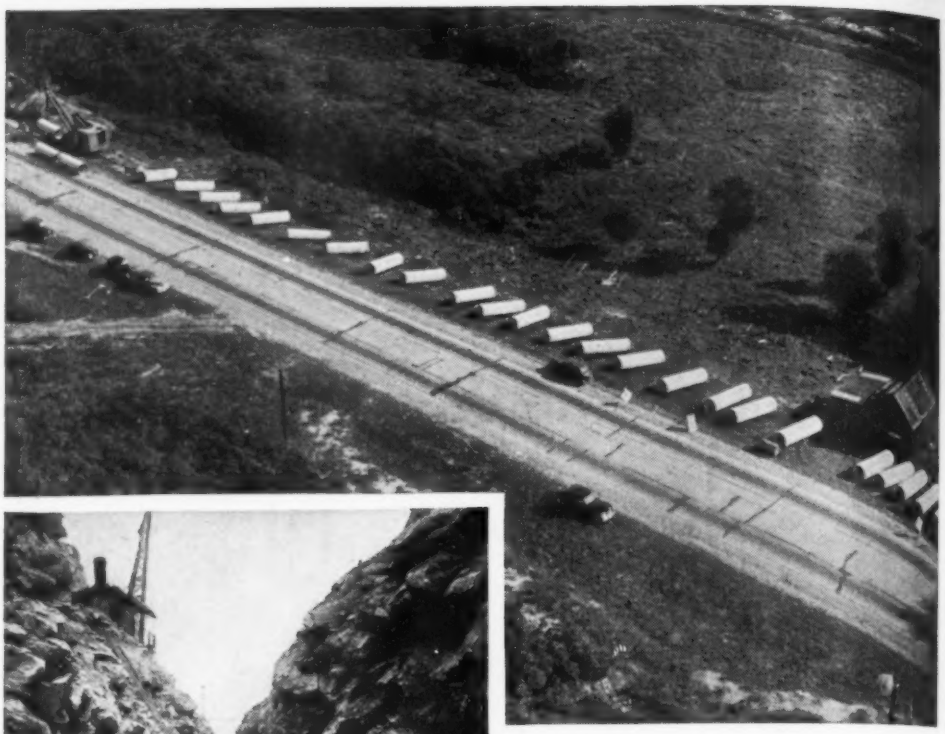
WATER & SEWAGE WORKS

CATHODIC PROTECTION STUDY TANKS OF THE HACKENSACK WATER CO.



YOU CAN'T BLAME WATER FOR THE HIGH COST OF LIVING



Above—1947: Installing the 48" Lock Joint Prestressed Concrete Cylinder Pipe Line for the Saginaw-Midland Water Supply Commission.

Left—1923: Installing the 277,000' Lock Joint supply line for the City of Tulsa, Okla.

NO COMMODITY SO VITAL TO SOCIAL AND ECONOMIC WELL-BEING CAN BE PURCHASED AS CHEAPLY AS WATER

Water which changes deserts into gardens and translates itself into heat, light, power and fire protection can be bought for pennies per ton, despite the fact that a sizeable investment is required to provide a water supply for a community.

To protect this important investment farsighted hydraulic engineers specify Lock Joint Reinforced Concrete Pressure Pipe, because they know that no pressure pipe line put into service by the Company has ever failed in the service for which it was designed. Since Lock Joint Reinforced Concrete Pressure Pipe maintains permanently its initial high carrying capacity, engineers are assured of maximum economy in pumping and maintenance charges.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

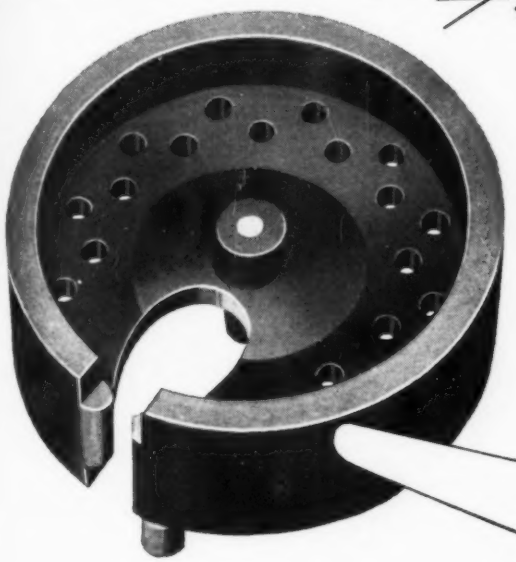
PRESSURE PIPE PLANTS: Wharton, N. J. • Turner, Kans.

BRANCH OFFICES: Cheyenne, Wyo. • Denver, Colo. • Kansas City, Mo. • Joplin, Mo. Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. Hartford, Conn.

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. August, 1948. Volume 95. Number 8. Published monthly by Gillette Publishing Co. at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; except *this issue*, 75 cents. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879. Executive and Business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N. Y.

the Famous Empire *Balanced* Oscillating Piston



it *Glides...*

for Greater Accuracy, Longer Life

In Empire Type 12 and Type 14 meters the *balanced,* oscillating piston smoothly glides in a circular motion between the halves of a snap-joint measuring chamber. Friction and wear are minimized by having the bearing area distributed over the entire circumference of the piston. And because the web of the piston is centered to equalize pressure above and below it . . . and because of its feather-weight, this piston practically floats between the mirror-smooth faces of the chamber.

This exclusive operating principle, unobtainable in any other water meter, has made Empire meters noted for their high degree of sustained accuracy. Even after many years of service, the *balanced,* gliding piston of an Empire will respond to the small flows that an ordinary meter might miss entirely.

PITTSBURGH EQUITABLE METER DIVISION
Rockwell Manufacturing Company
Pittsburgh 8, Pa.

Atlanta Boston Chicago Houston Kansas City Los Angeles
New York Pittsburgh San Francisco Seattle Tulsa

ROCKWELL

Empire OSCILLATING PISTON Meters

HORTON TANKS

PROVIDE GRAVITY PRESSURE TO IMPROVE MUNICIPAL WATER SYSTEMS

The installation of an elevated storage tank is often the first step taken to improve a community's water supply system. The additional water in reserve, and the dependable gravity pressure which an elevated tank provides make it possible for existing facilities to give better service. For example, studies of actual "before and after" pressure charts have proved many times that elevated water storage can be the determining factor in smoothing out pressure fluctuations in water distribution mains. Water in elevated storage also helps to meet peak demands, and is particularly advantageous in communities where there is a wide variation between the maximum and minimum rates of consumption. Other advantages are that the extra reserve of water helps to reduce pumping costs, provides a supply of water for emergencies, and often lowers fire insurance rates.

200,000-GALLON WELDED ELEVATED TANK SERVES CHERAW

The Horton elevated tank shown in the accompanying view was erected at Cheraw, S. C., to furnish gravity water pressure in the municipal water supply system. The new 200,000-gal. welded Horton tank, together with an existing 100,000-gal. elevated tank, provide a total elevated water supply of 300,000 gallons. The city's population of about 5,500 people, located in an area of 1½ sq. mi., is served by 11½ miles of mains.

Horton elevated tanks like the one at Cheraw are available for municipal use in standard capacities up to 2,000,000 gallons. There's a Horton tank made to meet the specific requirements of your community. For more information on elevated storage, write our nearest office.

CHICAGO BRIDGE & IRON COMPANY

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Houston 2	2115 National Standard Bldg.	Los Angeles 14	1455 Wm. Fox Bldg.	Atlanta 3	2181 Healey Bldg.
Tulsa 3	1646 Hunt Bldg.	Chicago 4	2198 McCormick Bldg.	Havana	402 Abreu Bldg.
New York 6	3390—165 Broadway Bldg.	San Francisco 11	1283-22 Battery Street Bldg.	Detroit 26	1551 Lafayette Bldg.
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WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

"A Machine of 101 Uses"

Is to be described and pictured performing some of the many services to which it can be put. A few of our readers may already be familiar with this "machine of 101 uses," but those who are not will without doubt be very envious of the author who is telling the story at our request after seeing the machine in service. He is—

ROGER W. ESTY, Supt.,
Water & Sewer Board, Danvers, Mass.

Cutting Cast-Iron Pipe

Is a paper which compares the better known methods of cutting cast-iron pipe and relates an improved method which involves simple electro-welding technic materially speeded up by the use of oxygen in the cutting arc. Considerable saving of time and materially reduced cost of making cuts is reported by—

SHERMAN L. ROGERS,
Supt. of Distribution, Hartford, Conn.

Results of Universal Metering at Naugatuck, Conn.

Were well on the plus side according to this logical follow-up article to the original published in *Water & Sewage Works* May 1945. The author is—

WM. H. MOODY, Supt.,
Naugatuck Water Co., Naugatuck, Conn.

The Pollution Assimilating Capacity of Streams

In these times of attempting to evaluate the pollution loading which a given stream may be expected to assimilate without creating a public nuisance, or hazard to public health, the author of this paper has developed a mathematically exact method of arriving at the safe pollution load for the more commonly met combinations of stream conditions. The end sought is the fullest permissible utilization of "self purification" of streams in determining the degree of waste and sewage treatment required. The author is—

HAROLD A. THOMAS, JR.,
Assoc. Prof. of Sanitary Eng., Harvard Univ.

The Use of Lime in Corrosion Control

Is a discussion of the underlying principles and basic considerations in the process of lime treatment of aggressive waters for corrosion alleviation, together with a description of practical control measures found most effective in lime treatment. The author is—

E. S. HOPKINS, Assoc. Engr.,
Bureau of Water, Baltimore, Md.

Sludge Digestion Practices—

Is the subject of a series of articles by a keen student and observer of sewage treatment practices. This series, now running, compares the various methods of sludge digestion currently practiced, with suggestions and recommendations born of observations, coupled with experience of practical plant operators. The author, who needs no introduction to our older readers, is—

LeROY Van KLEECK, San. Engr.,
Conn. State Dept. of Health, Hartford

Handling Chlorine Safely

Is an article which describes and pictures methods and procedures of handling, transporting and storing liquid chlorine safely. It also calls attention to some specific "don'ts" in handling chlorine if the maximum safety is to result. The experiences of many have been drawn on for this article by—

JOHN O. LOGAN, Chemical Engineer,
The Mathieson Chemical Corp., N. Y. City

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Publication Office, 404 N. Wesley Ave., Mt. Morris, Ill.

BUSINESS OFFICE
22 W. Maple St., Chicago 10, Ill.

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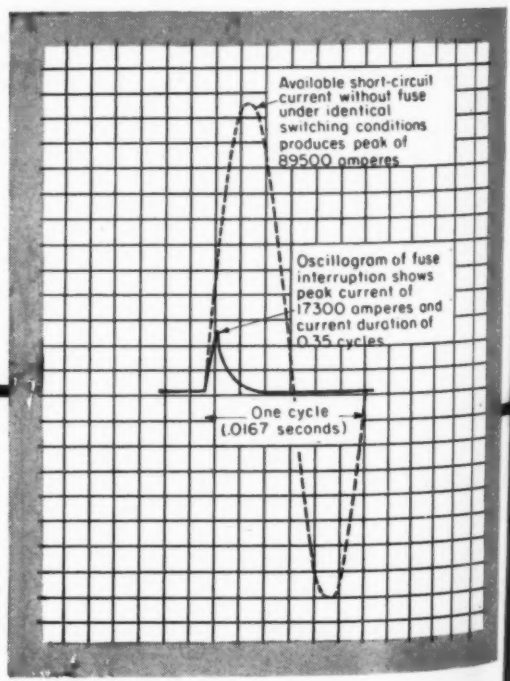
Low-cost repetitive starts ● Quick short-circuit

These easily replaceable fuses blow only on short circuits

WHAT IS LIMITAMP? Limitamp is the outstanding high-voltage motor control designed for repeated starting of large synchronous or induction motors. It is the only high-voltage motor control with air-break contactor—this means smaller, lighter moving parts, less inertia, less wear, hence longer life on repetitive operation. And because the contactor operates in air it's easy to service—no tanks to lower, no oil-handling problems. Units are completely factory-assembled in metal cabinets, and may be mounted singly or lined up to centralize all control functions in one location.

WHAT'S THE SECRET OF LIMITAMP? Secret of this high-voltage controller is the co-ordination of a new, high-voltage contactor with current-limiting power fuses for interrupting short-circuit currents. Fuses operate only under actual short-circuit conditions, and will not blow unnecessarily on motor starting or stalled current. Motor overload protection is provided by accurately calibrated isothermic relays which protect the motor from sustained running overloads, or stalled current. Limitamp controllers can be furnished with either instantaneous or time-delay undervoltage protection.

Rapid fuse action gives sure short-circuit protection, as evidenced by this oscillograph

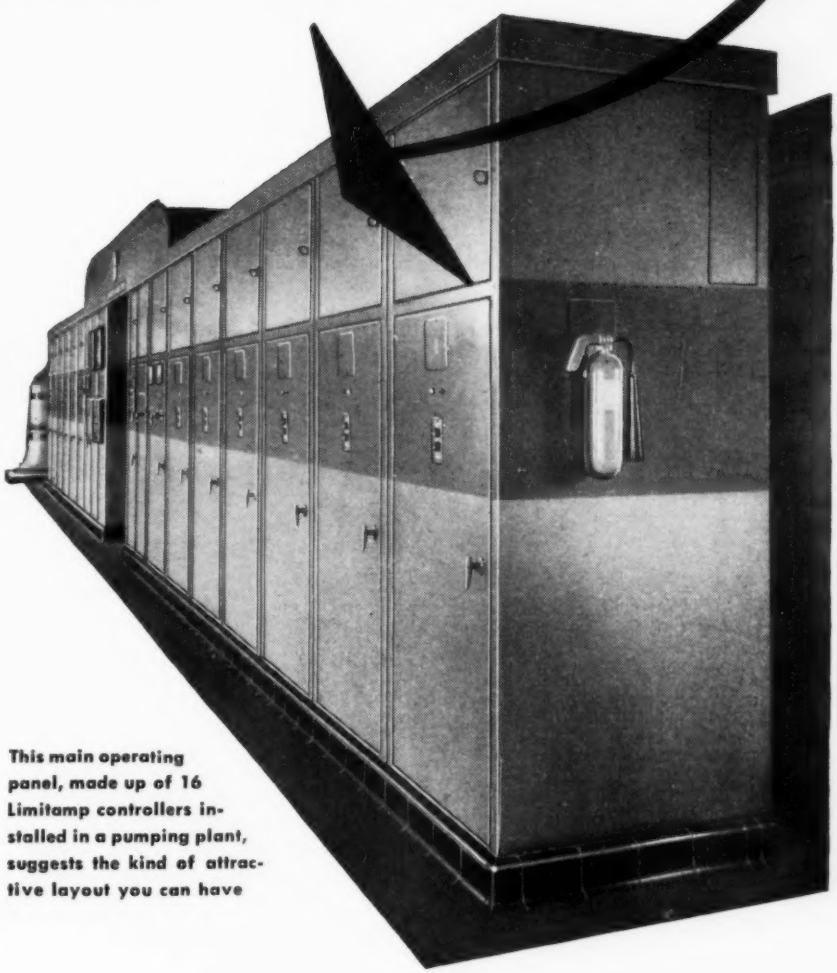

Available short-circuit current without fuse under identical switching conditions produces peak of 89500 amperes
Oscillogram of fuse interruption shows peak current of 17300 amperes and current duration of 0.35 cycles
One cycle (.0167 seconds)

interruption ● Attractive, uniform appearance

LIMITAMP control

ANY QUESTIONS? Full information on the application of Limitamp control in sewage or waterworks plants is yours for the asking from your consulting engineer or General Electric representative . . . or write for Bulletin GEA-4247.

Remember, if you elect to purchase *all* the electric equipment for your plant from General Electric, you will receive all the benefits of unit responsibility because you will be dealing with only one manufacturer . . . your engineering, buying, installation and servicing problems will be minimized. *Apparatus Dept., General Electric Co., Schenectady, N. Y.*



This main operating panel, made up of 16 Limitamp controllers installed in a pumping plant, suggests the kind of attractive layout you can have

"CLEAN WATERS" NAMED WORLD'S BEST

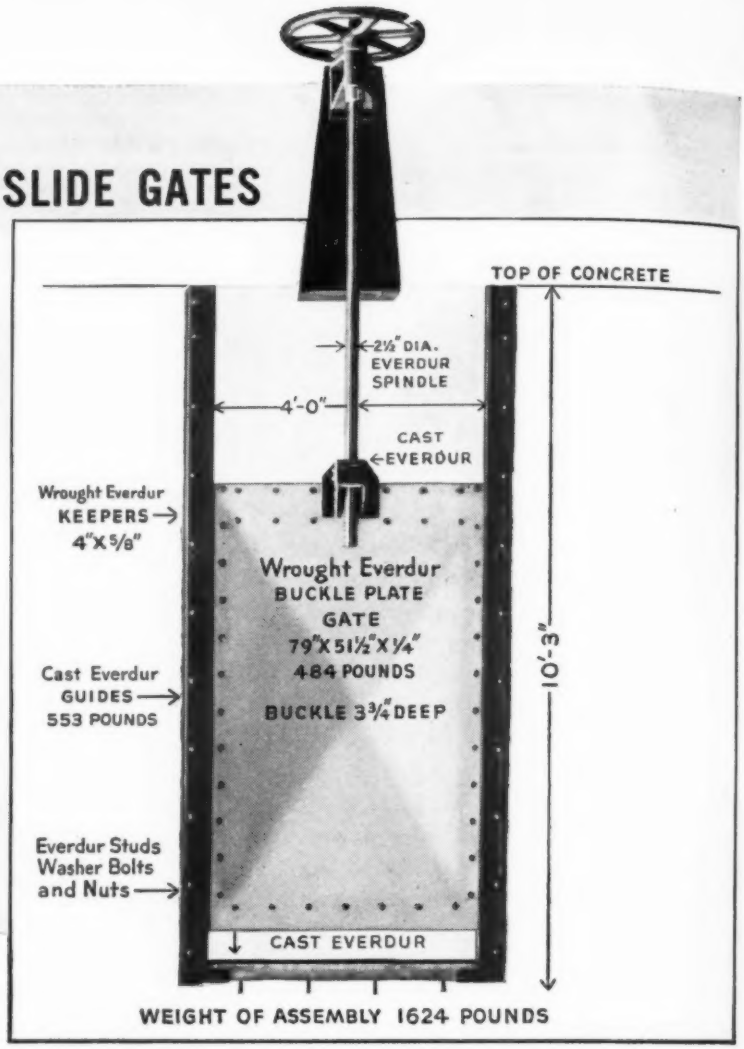
Chicago's Films of the World Festival recently selected "Clean Waters" as the world's best commercially sponsored motion picture! Produced by the U. S. Public Health Service and the General Electric Company, "Clean Waters" has spearheaded an effective nationwide campaign to end the pollution menace. This full-color and sound movie is available to you on a loan basis from any G-E office—see it and show it soon.

CO-ORDINATED
WATER-PLANT . . . SEWAGE-PLANT . ELECTRIFICATION

GENERAL ELECTRIC

FROM COTTER PINS TO SLIDE GATES

Everdur STANDS UP LONGER IN SEWAGE SERVICE



One of the five 13-year-old shut-off gates of Everdur Metal in the screen room of the Rahway Valley Joint Meeting Sewage Treatment Plant.

For 20 years Everdur® Copper-Silicon Alloys have performed well under the corrosive conditions imposed on sewage treatment equipment. These alloys have unusual resistance to corrosion. In addition, they provide high strength and, according to type, may be cast, hot or cold rolled, drawn, spun, forged or welded.

A good example of Everdur advantages is seen in the five shut-off gates in the screen room at Rahway, N. J., installed more than 13 years ago. These gates, which operate smoothly and easily by hand, weigh 1624 lbs., while cast, electrically-driven gates for the same service would have weighed well over four tons each!

In view of the fact that sewage service must not fail, a cotter pin may be as essential as the most massive equipment. Thus, Everdur Metal has been more and more widely specified for such uses as:

Coarse and Fine Screens
Swing Gates
Built-up Sluice Gates
Bar Rack Aprons
Effluent and Scum Weirs
Scum Baffle Brackets
Troughs
Screen Hoppers
Orifices
Backets
Anchors
Ladders
Float Gage Chains
Valve Springs
Manhole Steps
Guides
Walkways
Bars and Plates
Bolts and Nuts

For detailed information, write for Publications E-11 and E-5.

*Reg. U. S. Pat. Off. 47185

ANACONDA
Everdur
COPPER-SILICON ALLOYS
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General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
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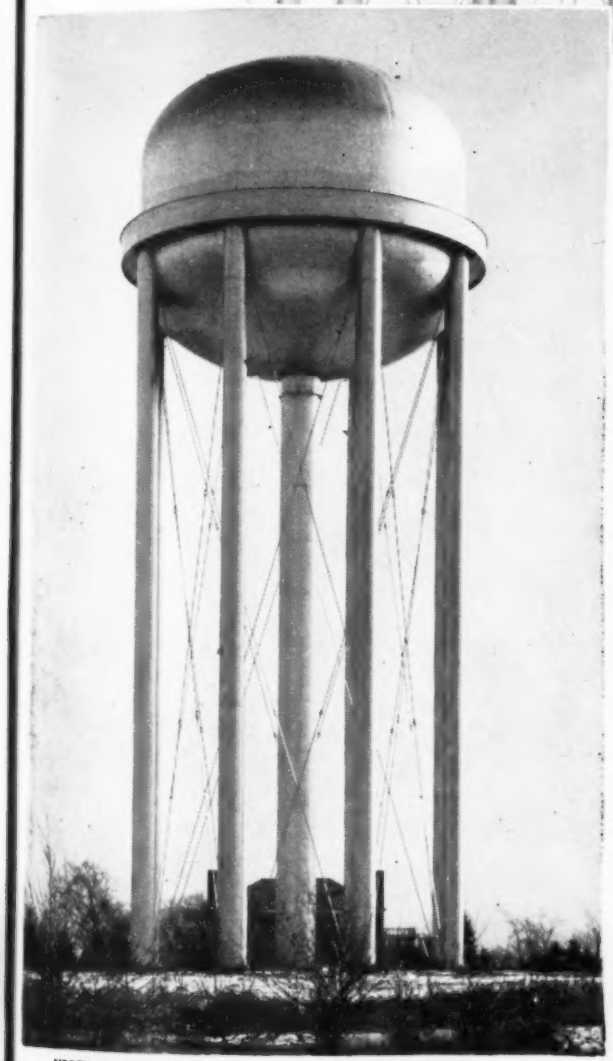
New Toronto, Ont.

When APPEARANCE is a factor... joined with sound efficiency and economy in MODERN WATER STORAGE...

Specify



UPPER PHOTO
This 60 ft. diameter toro-ellipsoidal tank stores 500,000 gallons of water within a 25'0" head range. Height from foundation top to tank bottom is 100'0".

LOWER PHOTO
500,000 gallons of water are stored 92'10" above foundation tops in this 50'0" diameter double-ellipsoidal type tank, having a head range of 39'2".

TUBULAR COLUMN TOWER

ELEVATED STEEL TANKS

by **PITTSBURGH •DES MOINES**

Architecturally handsome appearance, complementing the character of high-value districts, is a *plus* advantage of our Tubular Column Tower elevated steel tank design.

Furnished in double-ellipsoidal or toroidal-bottom types, these tanks are available in a wide range of capacities for every community demand—providing better water service at lower cost, with attractive aspect in any locality. *Write for a consultation.*

PITTSBURGH • DES MOINES STEEL CO.

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Sales Offices at:

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SEATTLE, 526 First Avenue, South
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OF ALL THE CAST IRON WATER MAINS EVER LAID IN THESE 25 CITIES SINCE 1817 IN SIZES 6-INCH AND LARGER

Alexandria, Virginia
Babylon, New York
Clinton, Iowa
Clyde, New York
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Huntington, West Virginia
Jamaica, New York
Merrick, New York
Norwich, New York
Ottawa, Ontario
Philadelphia, Pennsylvania
Portland, Maine
Rochester (Suburban), N. Y.
St. Mary's, Pennsylvania
St. Paul, Minnesota
Sag Harbor, New York
Scranton, Pennsylvania
Springfield, Massachusetts
Summit, New Jersey
Syracuse (Suburban), N. Y.
Utica, New York
West Palm Beach, Florida
Winnipeg, Manitoba

Mr. Q-Check says:
Utica, New York, laid its first 6-inch cast iron pipe 99 years ago and 98% of all cast iron pipe of that size ever laid is still in service.

CAST IRON PIPE

96%

ARE STILL IN SERVICE

We are stating a fact and you don't have to take our word for it. We refer you to one of the most important fact-finding jobs ever undertaken by the water works industry—the recently completed survey of the service life of water works facilities. This survey was sponsored by three water works associations.

The survey shows that *96%* of all the cast iron water mains ever laid by 25 representative cities in sizes 6-inch and larger *are still in service.*

These cities had laid 50 million feet—nearly 9500 miles—of 6-inch and larger cast iron water mains since 1817. They were selected by the Joint Committee, which directed the survey, as representing a cross-section of water service conditions throughout North America.

A detailed report of the survey has recently been published by the American Water Works Association. We have reprinted, by permission, the facts pertaining to cast iron water mains in a brochure which will be sent on request. Write to Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Ave., Chicago 3, Ill.

SERVES FOR CENTURIES

Crane Valves

do more than safeguard public health

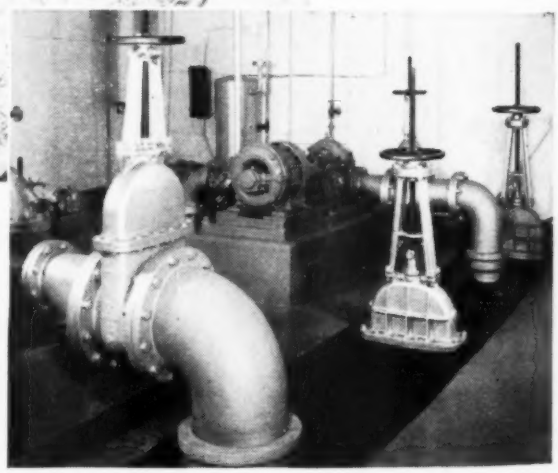
That's right! Crane valves in water and sewage systems do *more* than safeguard the health of city, suburb, and town. They safeguard operating expenses, as well. By giving long and dependable service under all conditions, Crane valves and fittings hold maintenance, repair and replacement costs to an extremely low level.

Crane Quality valves and fittings have always satisfied the highest standards set by the men responsible for public water supply and sewage disposal services. It's only natural—because Crane has steadily shared in the development of flow-control equipment for more than 90 years.

Crane Co., 836 S. Michigan Avenue, Chicago 5, Ill. *Nation-wide Service Through Branches and Wholesalers.*

FOR ECONOMICAL SERVICE IN LOW PRESSURE *water, steam or gas lines —Crane No. 793½ Iron Body Double Disc Gate Valves with brass trim. Ideal for services not requiring "standard" weight valves. Short and compact; occupy minimum space. Rated at 25 pounds steam; and up to 50 pounds cold water. Sizes: 10 in. and larger. See your Crane Catalog, pp. 122-123.*

New Supply Line *from reservoir of large city showing installation of Crane 48-inch A.W.W.A. gate valves, bevel gear operated.*



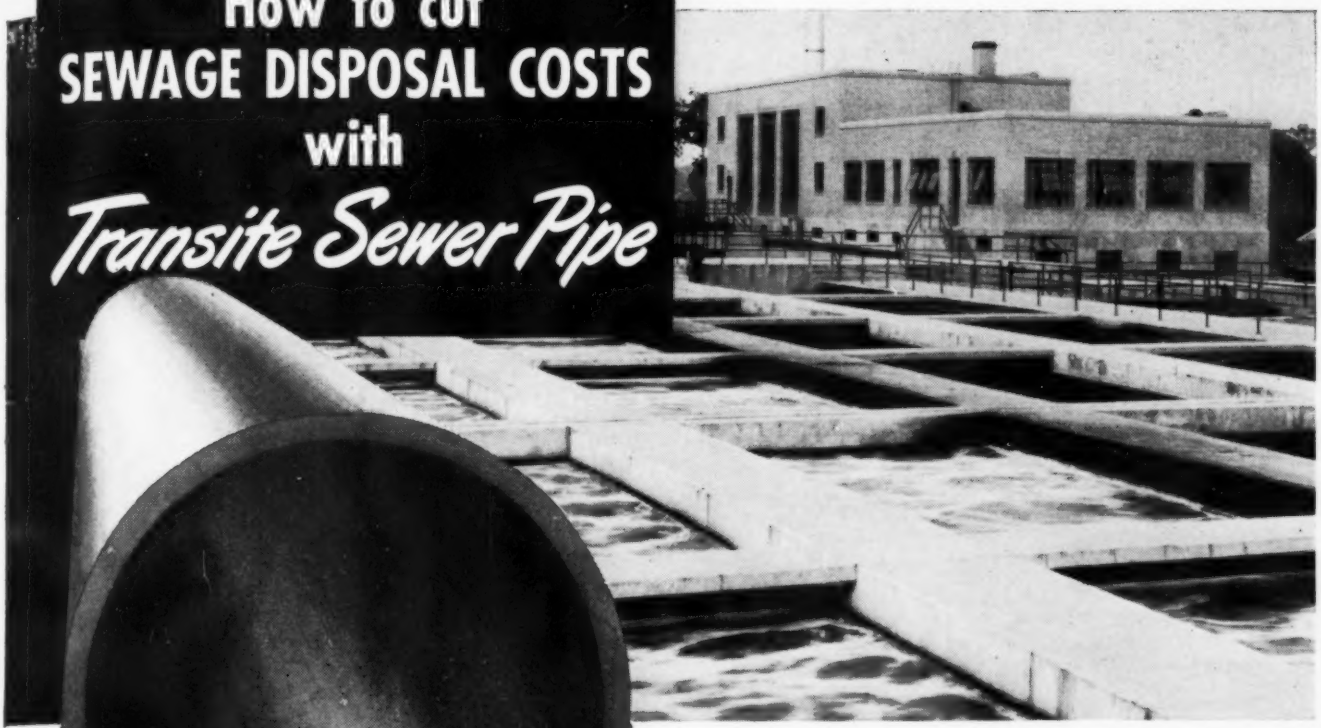
Raw Water Inlet *to high service pumps in suburban water plant, equipped with Crane low pressure gate valves.*

VALVES · FITTINGS · PIPE

CRANE

PLUMBING AND HEATING

How to cut SEWAGE DISPOSAL COSTS with *Transite Sewer Pipe*



Reduced Treatment Costs

Two features of Transite* Sewer Pipe present an opportunity for important savings in the treatment of sewage:

1. Sleeve-type joints that make up tight and *stay* tight in service.

2. Long 13-foot lengths that mean fewer joints in the finished line.

This double safeguard against infiltration—*tighter* joints as well as *fewer* joints—has the practical effect of reducing the load at the disposal plant . . . often to the extent that overall treatment costs are substantially cut.

This reduction in sewage load also enables plant capacity to be conserved for future needs. And, where new treatment facilities are being planned, it permits consideration of a smaller plant . . . with possible economies in both buildings and equipment.

Transite offers other economies, too. Other important savings are possible with this pipe because it has an exceptionally smooth interior which offers minimum resistance to the flow of sewage. Its flow capacity is unusually high—n=.010. This often permits use of flatter grades and shallower trenches—with correspondingly lower excavation costs. Or, as an alternate economy, smaller diameter pipe may be used.

Low maintenance through the years. Made of asbestos and cement combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low annual maintenance costs through the years.

For Further Information. If you are seeking ways to lower sewage disposal costs, send for the Transite Sewer Pipe brochure. Write Johns-Manville, Box 290, New York 16, N. Y., for your copy.

*Reg. U. S. Pat. Off.

Johns-Manville

JOHNS-MANVILLE JM PRODUCTS

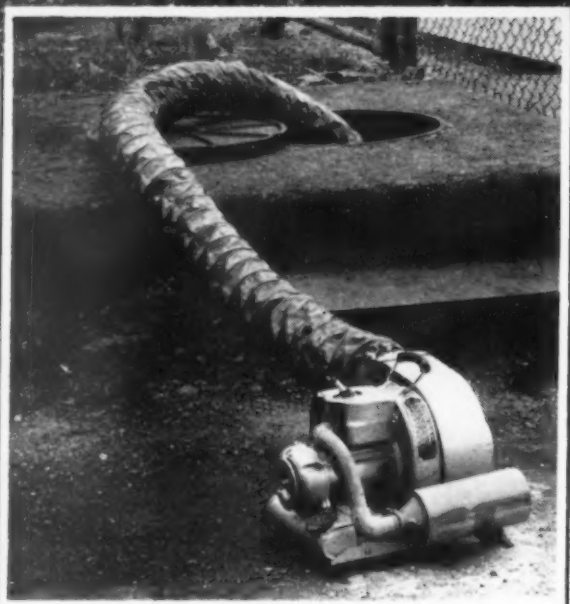
Transite Sewer Pipe

Give them Air...

fresh air...and plenty of it with

HOMELITE

Carryable Blowers



Here's Another Way

Attach the duct to the air discharge end of the Homelite and *blow* fresh air down into the manhole. One of the many good features of a Homelite Carryable Blower is its adaptability to both the suction and forced-air methods of ventilation.

Here's One Way

Give your men good, safe underground working conditions by *sucking* noxious gasses and steam out of manholes with a Homelite Gasoline-Engine-Driven Blower. You simply extend the Homelite collapsible air duct from the intake end of the blower to the lower part of the manhole. Automatically and quickly the Homelite Blower sucks the bad air out of the manhole and, at the same time, draws in a steady flow of safe, fresh air.

Light and compact, a Homelite Blower is easy to get around . . . easy to carry by one man. Complete unit including built-in gasoline engine weighs only 40 lbs. and handles up to 1000 cubic feet of air per minute. Other models available with capacities of 2000 C.F.M. and 5000 C.F.M.

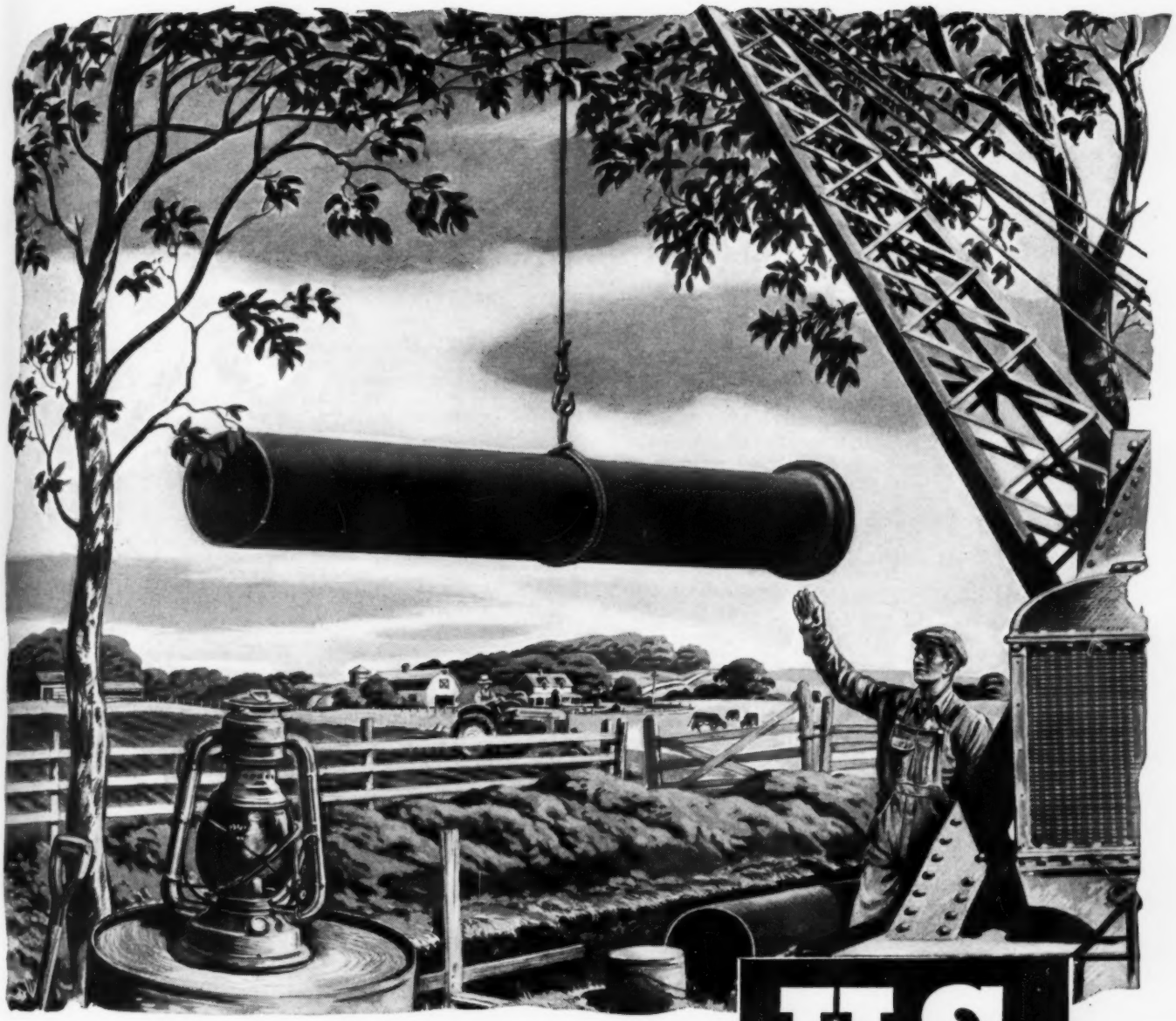
Send for complete information

HOMELITE

CORPORATION

708 RIVERDALE AVENUE, PORT CHESTER, NEW YORK

Manufacturers of Homelite Carryable Pumps Generators • Blowers • Chain Saws



Painted for U. S. Pipe & Foundry Co. by Paul Laune

U.S. PIPE

THE rewards of research are evidenced by the progressive improvements in U. S. Cast Iron Pipe during the past quarter-century. First, the development of deLavaud centrifugally cast pipe—a stronger, lighter cast iron pipe costing the user less per foot. Then, the development of the Super-deLavaud process producing a centrifugally cast pipe with greatly improved physical properties. These major developments have been augmented by a number of manufacturing refinements which have resulted from a continuous, intensive research and development program. Such refinements have made it possible to improve and control more closely the quality of our products. **United States Pipe and Foundry Co., General Offices: Burlington, New Jersey. Plants and Sales Offices Throughout U.S.A.**

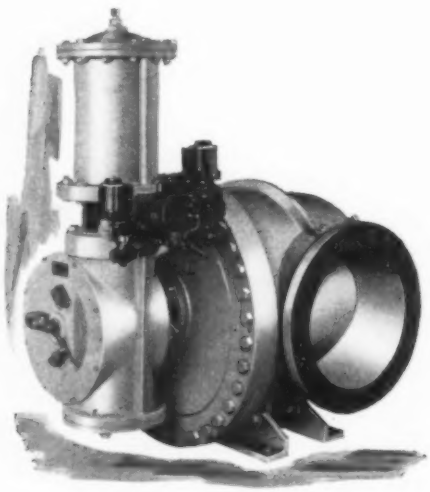
Dangerous Days -

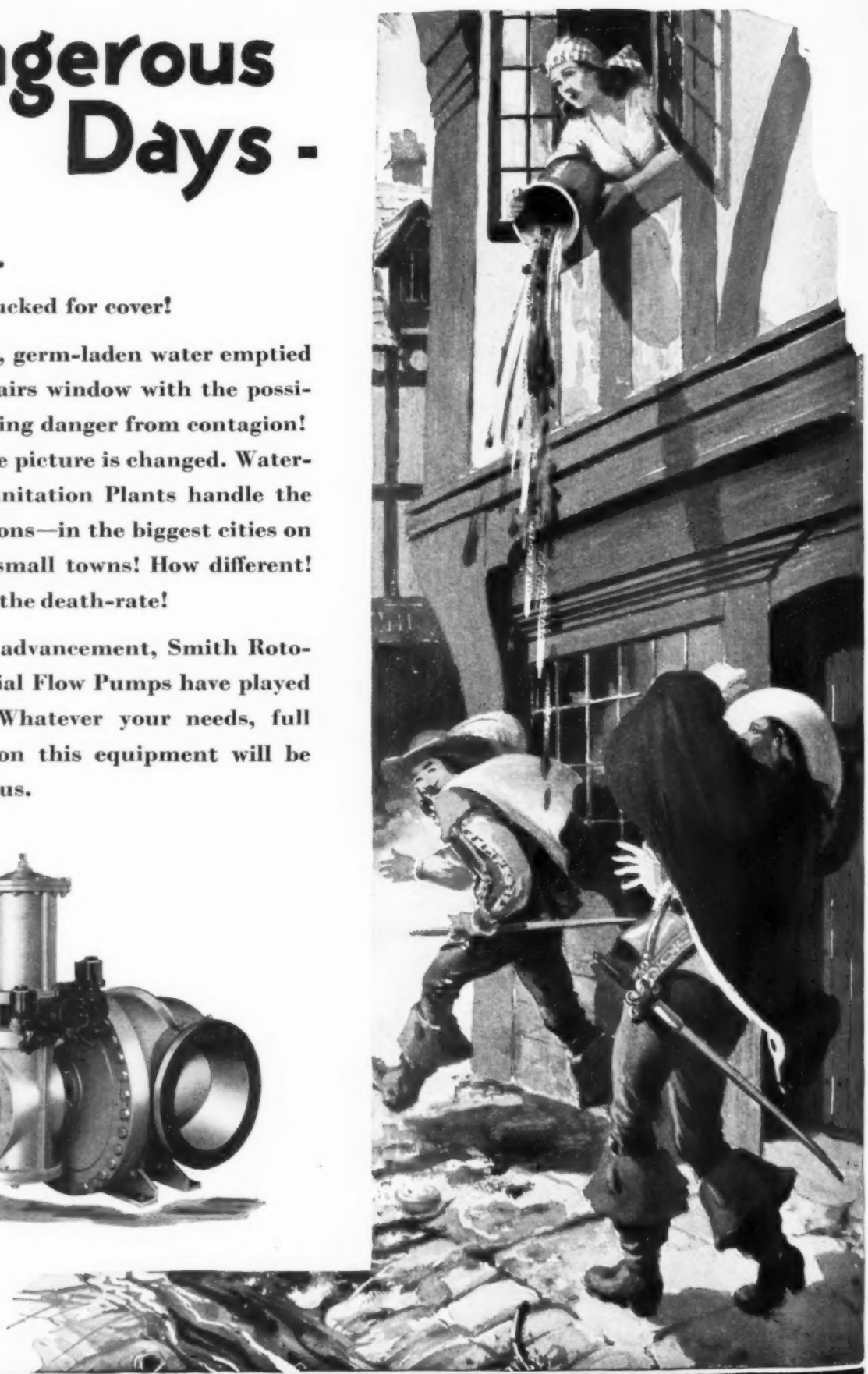
SPLASH! . . .

And people ducked for cover!

A jar of filthy, germ-laden water emptied from an upstairs window with the possibility of creating danger from contagion! But today, the picture is changed. Waterworks and Sanitation Plants handle the needs of millions—in the biggest cities on down to the small towns! How different! What a cut in the death-rate!

In this great advancement, Smith Rotovalves and Axial Flow Pumps have played their parts. Whatever your needs, full information on this equipment will be useful. Write us.





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stabilizes
water
following
lime
softening

** T. M. Reg. U. S. Pat. Off.*

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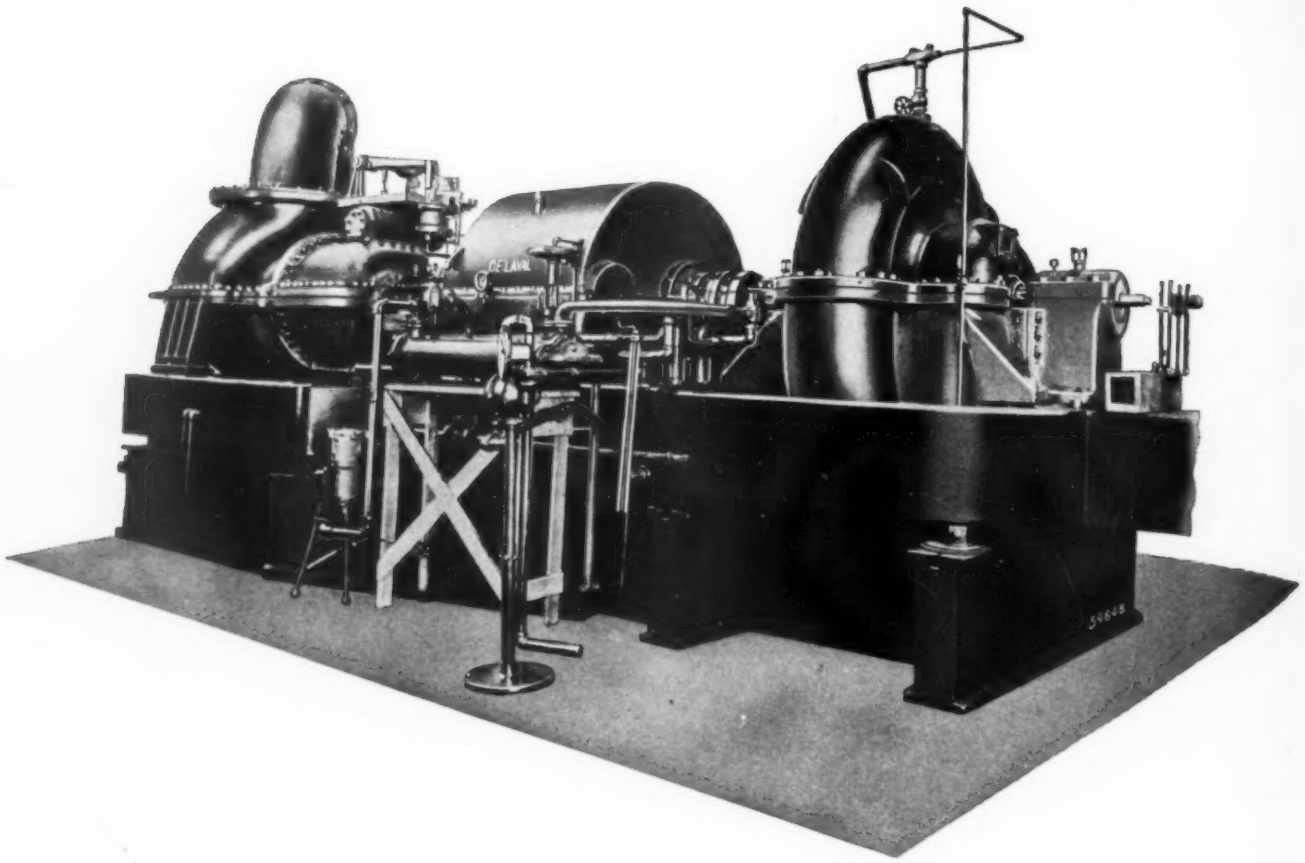

On test for Chicago

DE LAVAL 75 mgd TURBINE-DRIVEN PUMP

Within the last twenty-seven years the City of Chicago has installed De Laval pumping units having a combined capacity of one billion, two hundred and forty-five million gallons daily. The latest of these is a De Laval 75 mgd pump driven by a De Laval turbine employed to provide maximum economy at varying rates of delivery.

DE LAVAL WW4

STEAM TURBINE CO., TRENTON 2, NEW JERSEY

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On the ball...

The Bettmann Archive

Thorough experience... an instinct to pioneer... and resourcefulness in meeting industry's needs for quality-controlled electro-chemicals have "sparked" Niagara's services for nearly half a century, and won enduring customer confidence.

It is this rigid adherence to quality standards... dependability in products and service at all times... that continues to distinguish Niagara Caustic Soda, Caustic Potash, Carbonate of Potash, EBG Liquid Chlorine, Paradichlorobenzene and Niagathal (Tetrachloro Phthalic Anhydride).

May we serve you, too?

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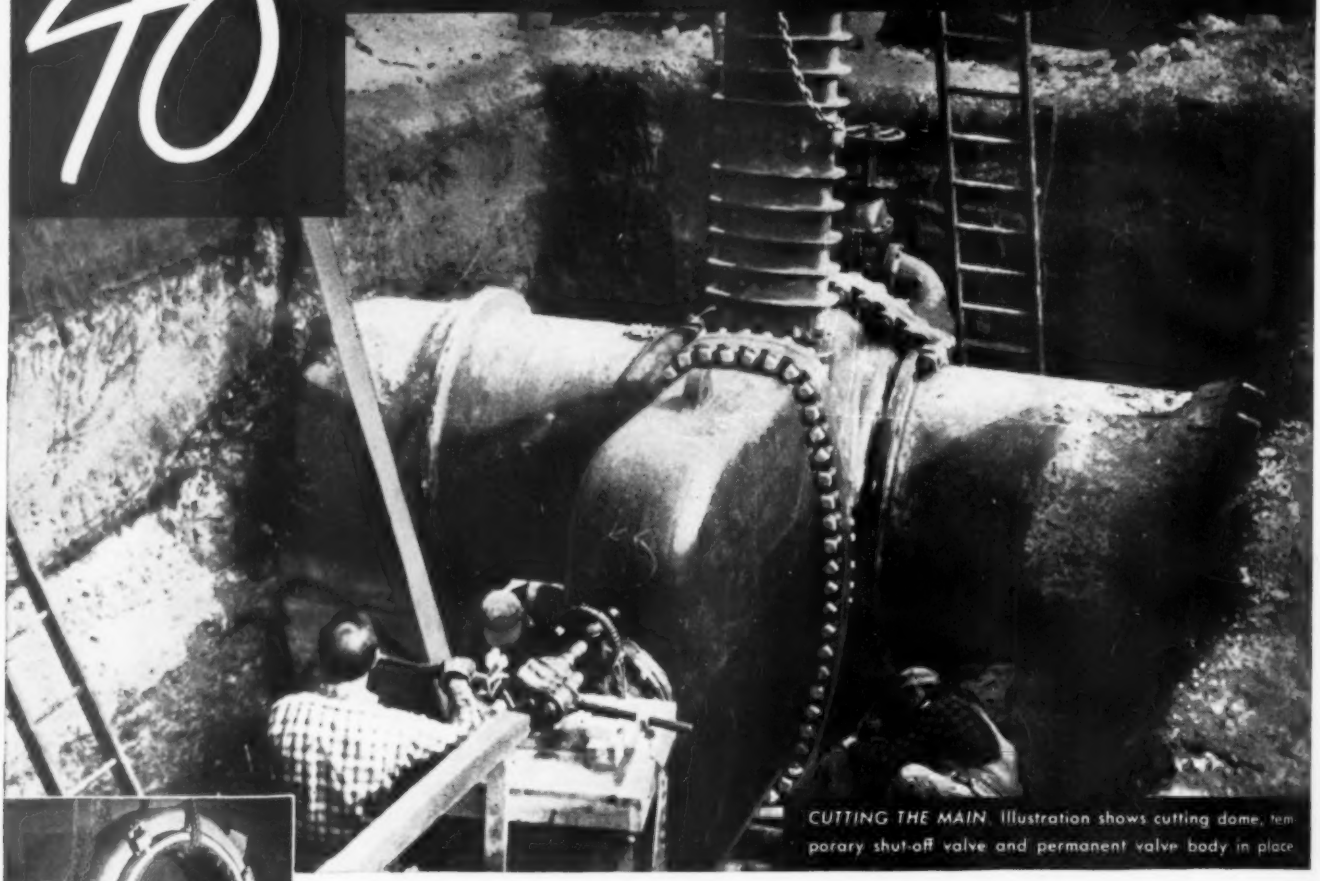
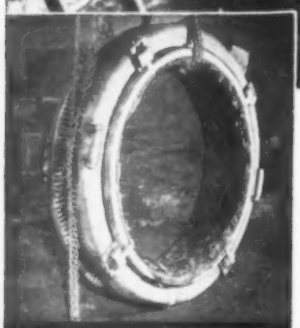
LIQUID CHLORINE • CAUSTIC POTASH • CARBONATE OF POTASH • PARADICHLOROBENZENE • CAUSTIC SODA • NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)

* 48" GATE VALVE INSERTED UNDER PRESSURE

to Avoid Stoppage of Steel Production

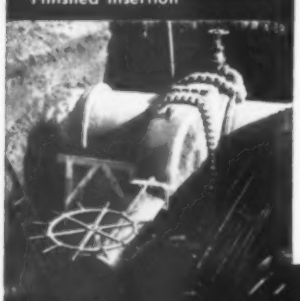


CUTTING THE MAIN. Illustration shows cutting dome, temporary shut-off valve and permanent valve body in place



Section removed from main

Finished insertion



At a large Eastern steel mill uninterrupted production depended upon a thirty year old, 48" cast iron main, carrying sea water used for cooling the furnace jackets. The main was in poor condition — badly corroded and electrolytically pitted.

In order to provide an emergency by-pass in the event of line failure, a gate valve was required. Since the mill could not risk even a momentary shut down, Smith was asked to insert the valve under pressure. Although of unprecedented size, the insertion was completed in four days without interruption of service or reduction in pressure.

*First 48" insertion ever made under pressure. One month later a second 48" gate valve was inserted by Smith for the Water Bureau, Philadelphia, Pa.

29

GATE VALVES
CHECK VALVES
FIRE HYDRANTS
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.
ESTABLISHED 1896
EAST ORANGE, NEW JERSEY

FLOOR STANDS
INDICATOR POSTS
TAPPING MACHINES
INSERTING MACHINES
PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES

5 REASONS WHY ALOXITE Diffusers Provide More Effective Sewage Aeration

Better results in various phases of primary and secondary sewage treatments follow installation of ALOXITE aluminum oxide porous plates and tubes. Here is the explanation:

1	UNIFORMITY OF STRUCTURE	● Assures uniform supply of small bubbles ● Increases oxygen absorption ● Provides more efficient treatment
2	RUGGEDNESS	● Permits repeated handling ● Cuts replacement costs
3	LOW PRESSURE LOSS	● Lowers operating pressures ● Reduces blower maintenance
4	CORROSION RESISTANCE	● Resists chemicals in sewage ● Withstands chemical cleaning
5	DURABILITY	● Gives longer diffuser life ● Eliminates frequent shutdowns for replacements

DIFFUSER MEDIA

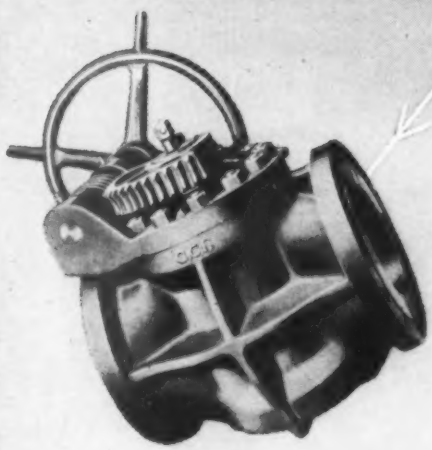
BY CARBORUNDUM

TRADE MARK

Call in our engineering staff to advise on specifications, installation and operation of ALOXITE diffusers. Their help may prove particularly beneficial. In the meantime, write Dept. M-88, The Carborundum Company, Refractories Division, Perth Amboy, N. J., for a copy of Engineering Bulletin No. 0-87

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Only a Cylindrical Plug turns so easily!



Precision machined, the a.c.f. Cylindrical Plug operates without wedging in its seat. It makes possible a port opening of full pipe area where needed, with retention of compact plug valve construction.

a.c.f. CYLINDRICAL FULL PIPE AREA LUBRICATED PLUG VALVES

Representatives in more than 50 Principal Cities

A.C.F. Valves are ideal for sewage operations. Ask for Catalog 3-W—American Car and Foundry Company, Valve Division, 30 Church Street, New York 8, N.Y.

Alhydro FLOC PRODUCER

PATENTS PENDING

FOR INDUSTRIAL OR MUNICIPAL WATER TREATMENT PLANTS -- AND SWIMMING POOL INSTALLATIONS

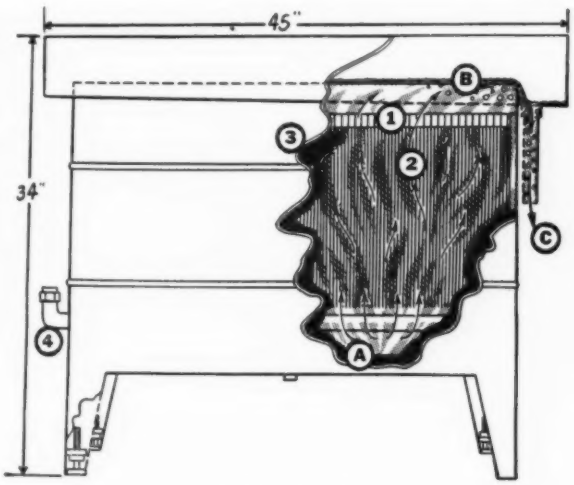
"...produces efficient floc in any water normally used..."

"and there's no need to chemically correct the water before or after treatment..."

Extensive tests conducted under a wide variety of representative water conditions have proved that the Alhydro Floc Producer will produce an efficient floc at any pH from 4 to 12 . . . and at temperatures normally found in industrial or potable waters . . . even extremely cold or warm waters.

Concentrated aluminum hydroxide floc is produced in the Alhydro unit by low voltage electrolytic decomposition of easily replaceable aluminum plates. This method of producing floc by electrolysis permits control of the floc concentration and results in an unusually stable floc that will re-form immediately if broken up. Since 69 lbs. of aluminum Alhydro plates will treat as much water as nearly ¾ ton of coagulants, the problem of chemical storage is minimized.

One Alhydro Floc Producer will treat 300,000 gallons of water per day . . . but the units can be installed singly or in multiples in existing or new water treatment plants.



1. **Bus Bar on each side of tank.**
2. **Alternate Stainless Steel and Aluminum Plates.**
3. **Composition Rubber Lined Stainless Steel Tank.**
4. **Water Feed Line easily removed for inspection.**

A. Water enters tank through slots in feed pipe.

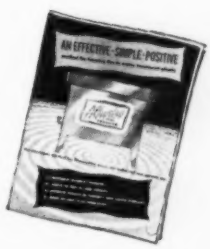
B. Concentrated floc rises to top and leaves through discharge trough.

C. Discharge pipe feeds floc to raw water.

● SKILLFUL ENGINEERING OF THE ALHYDRO FLOC PRODUCER GIVES *Simplicity of Operation ... Ease of Maintenance*

DESCRIPTIVE FOLDER—FREE

Read this folder which illustrates and describes the advantages of the compact Alhydro Floc Producer. See how you can simplify the treatment of drinking water or water for industrial use. Write for free copy today.



ALHYDRO, INC.

(DEPARTMENT 8B)
516 N. CHARLES ST., BALTIMORE 1, MD.

Choose **CONCRETE PIPE** for

Strong, Durable and Economical Sewers

In a new 2,000-acre subdivision in Cincinnati, more than 4½ miles of concrete pipe, from 12" to 96" in diameter, is being installed in a combination storm and sanitary sewer.

Leading sanitary engineers all over America choose concrete pipe for sewer lines because it meets the three essential requirements: (1) strength to resist severe impact and to sustain heavy overburdens, (2) durability to render long years of heavy-duty service and (3) ***low-annual-cost*** economy.

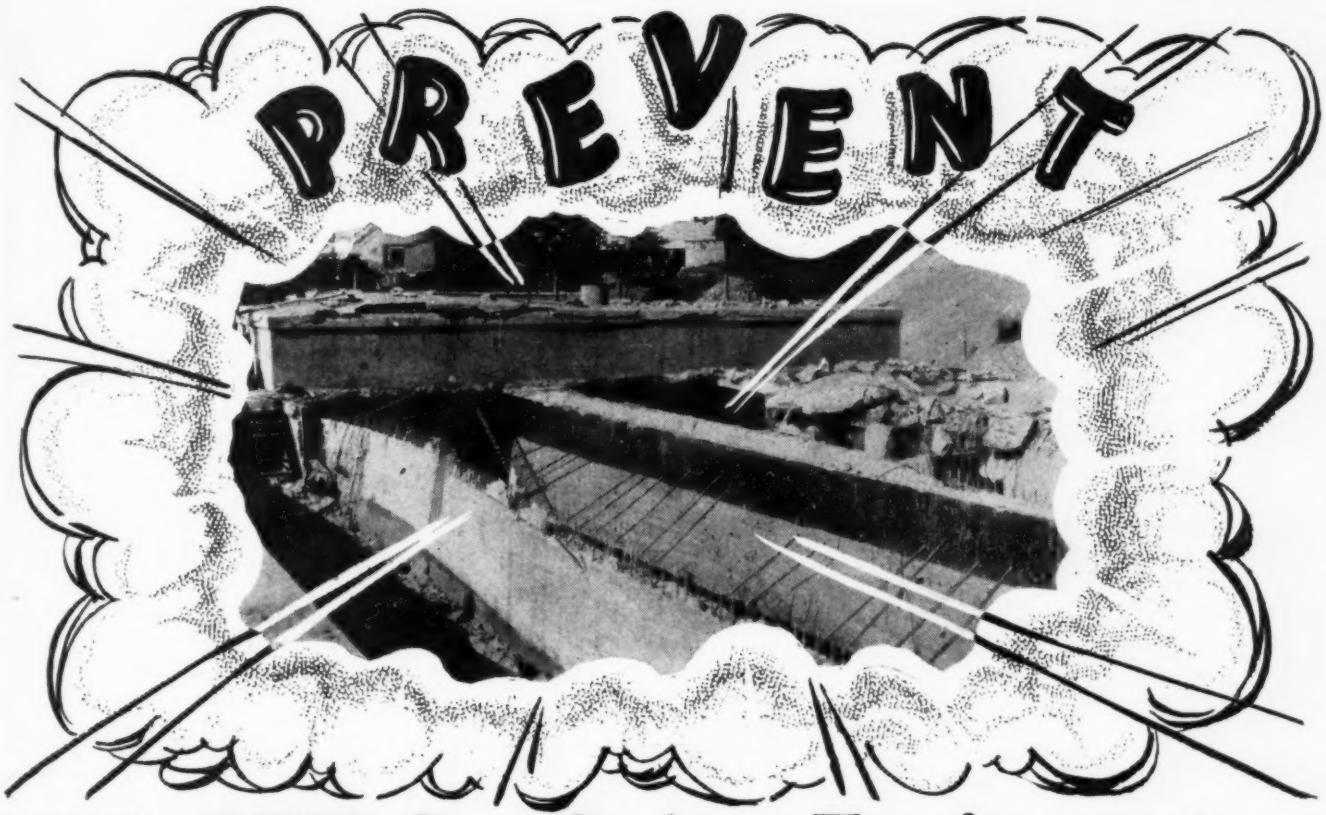
Concrete pipe serves economically because its first cost is moderate, its life long and its upkeep low. It serves efficiently because its smooth interior finish resists abrasion and provides maximum hydraulic capacity, because its tight joints and uniformly dense structure ensure minimum infiltration and leakage.

●

Photo shows 78" reinforced concrete pipe curved on a 65' radius in Cincinnati's new sewer. H. H. Kranz, City Engineer; A. B. Backherms, Sewer Engineer; T. J. Montgomery, Construction Engineer.

AMERICAN CONCRETE PIPE ASSOCIATION

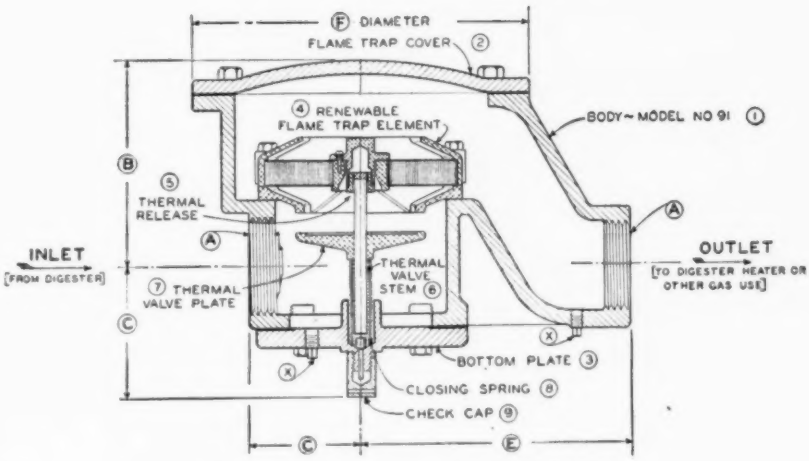
228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS



With PFT Gas *Safety* Equipment...

Don't let a disastrous explosion like this happen at your plant . . . here is visible proof that protective devices should be used at every location where an explosive mixture may be ignited.

PFT Floating Covers for Sludge Digestion Tanks have minimized the possibility of an explosive mixture being present in the gas piping system . . . PFT flame traps for 15 years have provided the last full measure of explosion prevention. Almost 2,000 units have successfully provided complete protection from explosive and burning mixtures passing flame into a gas supply line without the use of a liquid seal. Flame elements have passages as large as possible to reduce clogging and pressure losses yet small enough to prevent flame propogation; are rugged so as not to rupture while preventing an explosion; are non-corrosive in the presence of Hydrogen Sulphide, etc.; are readily removable for inspection. New improvements include: horizontal connections for easier installation; internal, accessible thermal plug to eliminate nuisance closure and possibility of gas leakage; body castings arranged for straight-through flow and designed in accordance with American Standards Class 125; more accessible replaceable parts; flame checks at all vent connections.



PFT MODEL NO. 91 FLAME TRAP

Send for Bulletin 221 which describes flame traps, pressure reliefs, waste gas burners, drip traps, pressure gauges, and suggested layouts for piping of gas safety systems.

P.F.T *Pacific Flush-Tank Co.*

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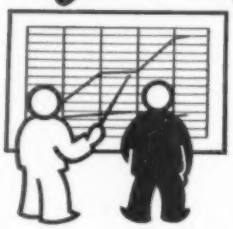
LOS ANGELES — SAN FRANCISCO — TORONTO

Performance is Proof



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"After all, the product itself speaks better than a lot of talk about it."

As manufacturers, the Clow organization's 70 years of continuous and successful operation "speaks" for the performance of Clow products, and for the products of its subsidiaries: Eddy Valve Company of Waterford, N.Y., established in 1849, and Iowa Valve Company of Oskaloosa, Ia., established in 1909; and the National Cast Iron Pipe division at Birmingham, Ala., established in 1912.

Currently, raw material shortages and delivery delays have directly affected our own deliveries, in spite of our huge capacity and modern plants. We hope before many months to be able to again give you the type of service which has for 70 years distinguished CLOW performance.

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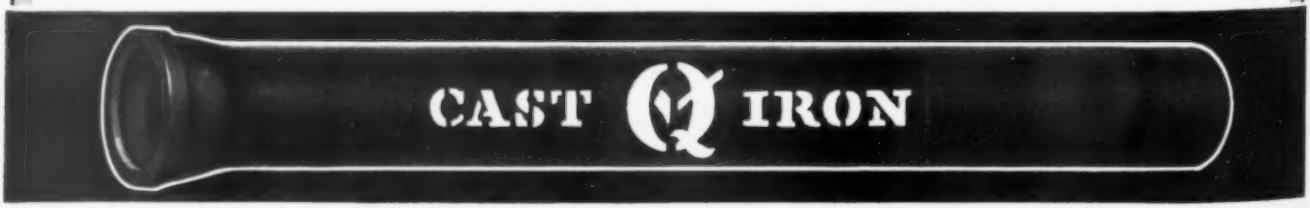
ADDRESS MAIL TO P.O. BOX 6600-A



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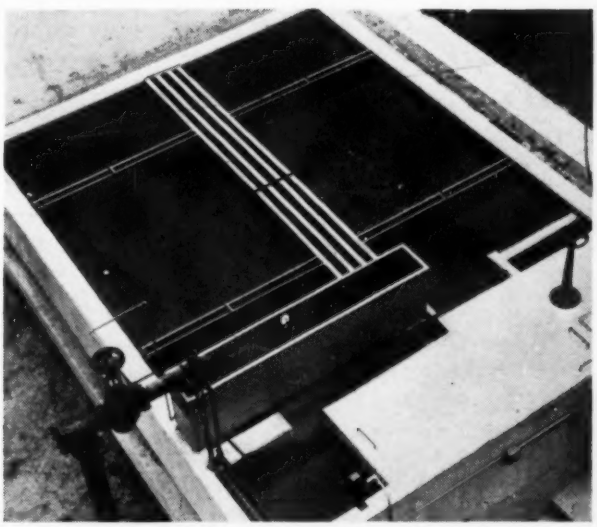
All undesirable impurities are removed from water supplies in less space, less time and at less cost with the Permutit (Spaulding) Precipitator. All savings are substantial! This Precipitator operates on the sludge blanket principle of upward filtration originated and introduced by Permutit.

Check the extremely economical features of the Permutit Precipitator! Better still, call in Permutit engineers for free consultation on your water conditioning problems. Write The Permutit Company, Dept. EN-5, 330 West 42nd Street, New York 18, N. Y., or the Permutit Company of Canada, Ltd., Montreal.

for 35 years
water conditioning
headquarters

Permutit



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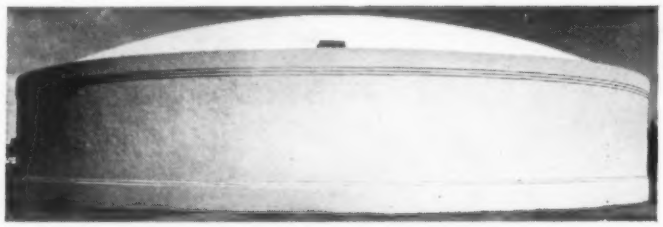
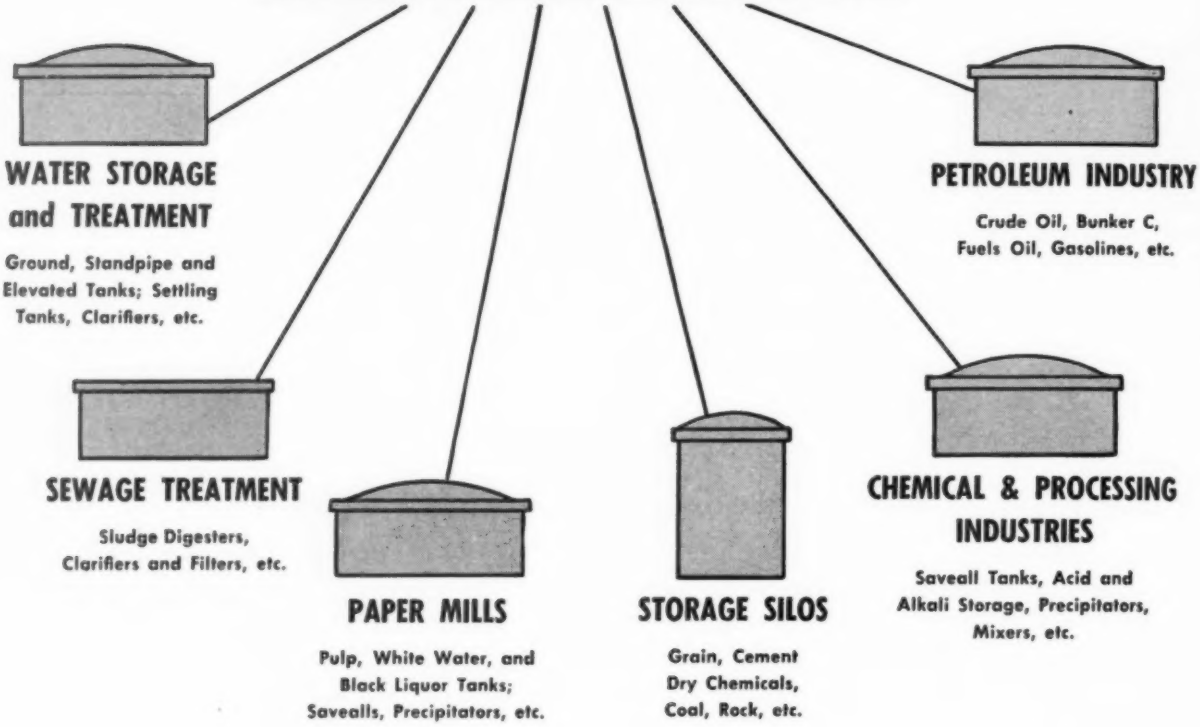
PRELOAD PRESTRESSED CONCRETE TANKS ARE IMMEDIATELY AVAILABLE FOR A WIDE VARIETY OF SERVICES—WITH ECONOMY IN DESIGN AND CONSTRUCTION AND WITH LOWEST COMPARATIVE LONG-TERM MAINTENANCE COSTS

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Send for tank data and our brochure "The Distinguished Clientele of The Preload Companies", a partial list which illustrates the wide versatility and established performance of Preload Tanks.

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For bulletin and full information write the Simplex Valve & Meter Company, 6743 Upland St., Philadelphia 42, Pa.

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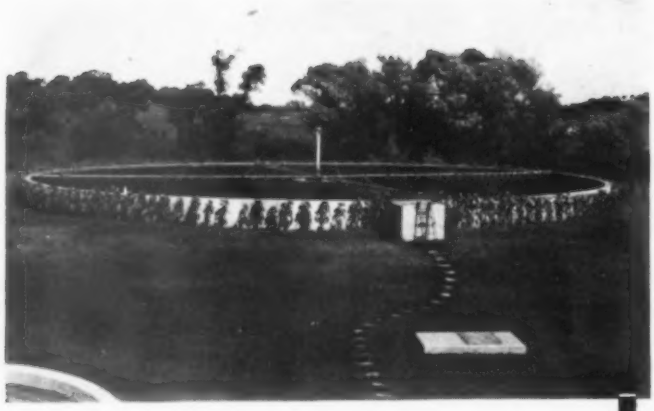

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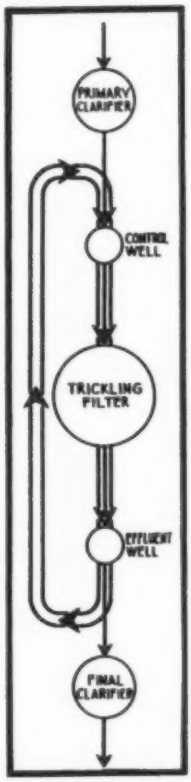

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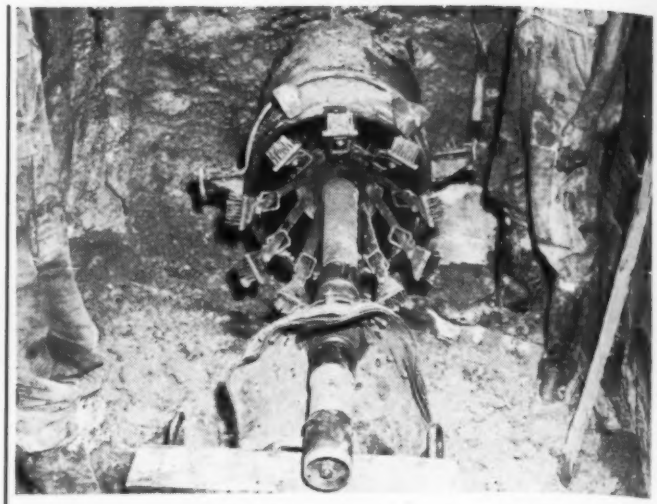

Photo shows actual use of brush type cleaner on a job in a large Southern city.

Now—Another NEW Service • • • Cleaning Cement-lined Pipes.

Surveys and analysis of cement lined pipes have proven conclusively that they need cleaning the same as other types of water mains. The sediment and plant growth within the cement lined pipe is of course of a different nature, an organic growth and a mold formation that requires SPECIAL TOOLS AND EQUIPMENT to remove.

Just as Pittsburgh Pipe Cleaner Company has pioneered in the cleaning and maintenance of *all* other types of water mains and sewer pipes, so they have designed just the RIGHT TOOLS AND EQUIPMENT for this type of cleaning. In the photo above is the new type brush cleaner in actual operation.

This method restores original capacity of pipes without a complete shut down of your operations. Ask about this new service today.

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AND NOW . . . A complete survey of your water supply and disposal problems.

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Aluminum Sulfate is almost universally accepted by water experts as the best coagulant for removal of turbidity, color and bacteria from water . . . and General Chemical Aluminum Sulfate is the outstanding choice the nation over. That's because its high quality and constant uniformity have given it a time-tested reputation for reliability among operating men in towns and cities all over America.

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4. Clear, colorless effluents are possible.
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6. Treated digested sludge dries quickly with minimum of odor.
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8. Economical to use.

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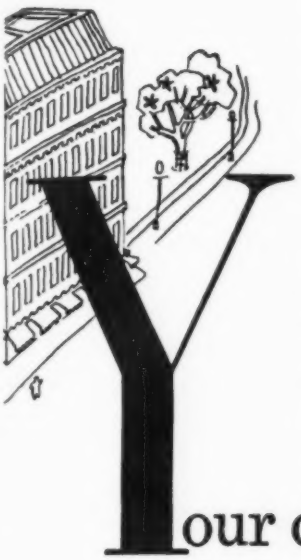

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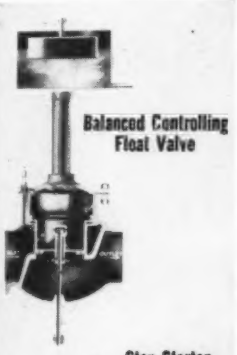

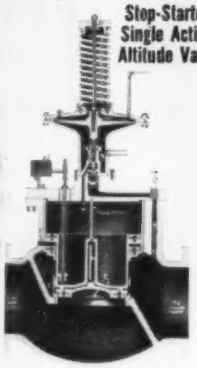

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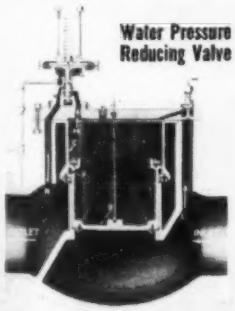

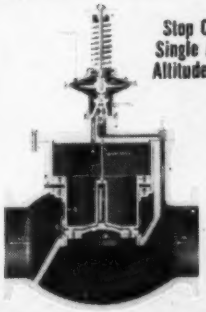

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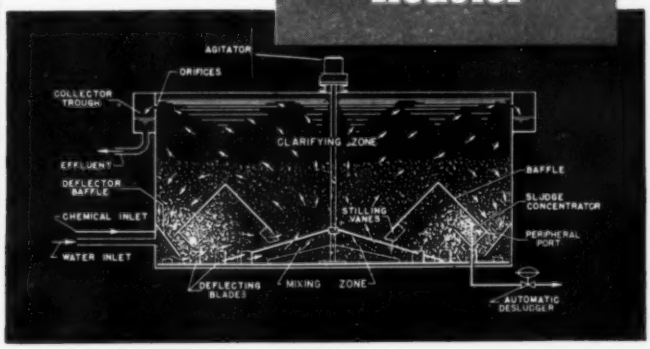

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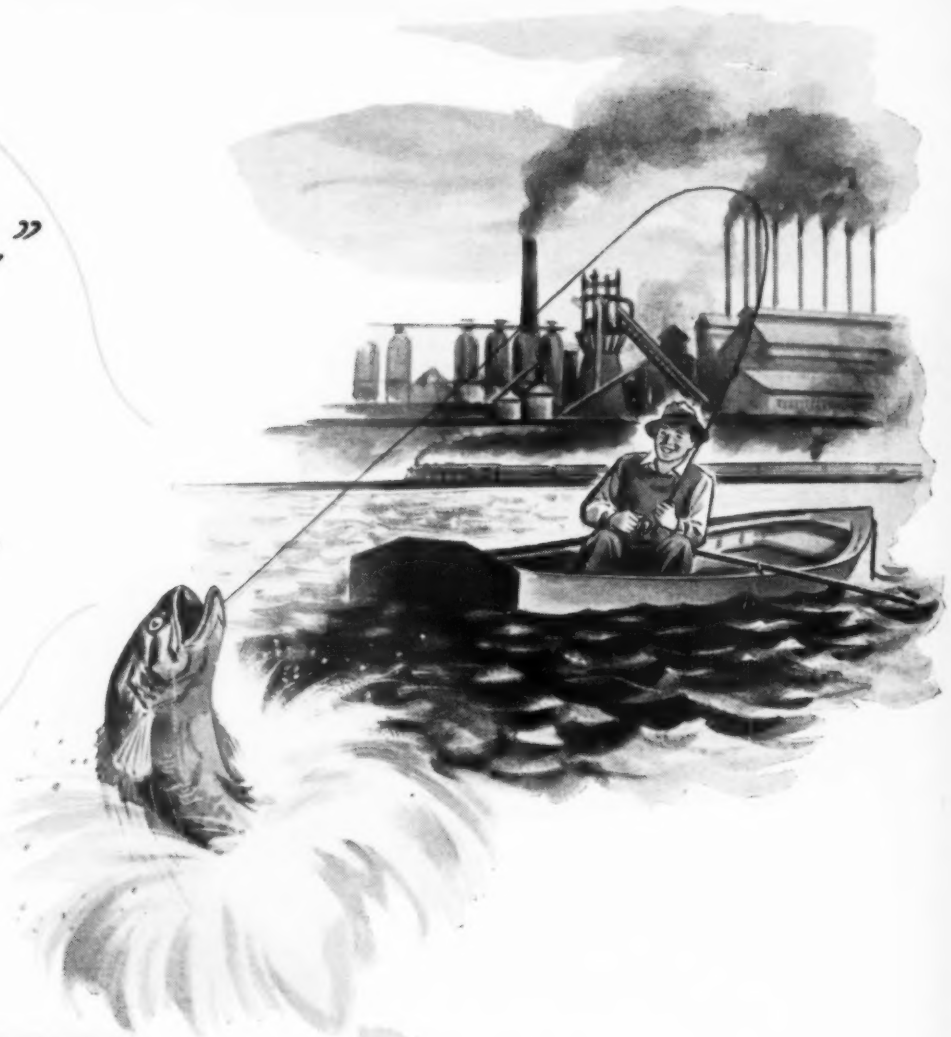
WSW-8-48

CHLORINE

"Go Fishin'" in the River beside your plant?



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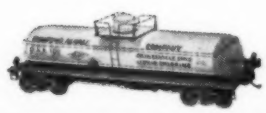
will help make it possible!

Fishing and other recreational activities along our rivers and streams are becoming more and more a reality as federal, state and local programs progress toward the elimination of stream pollution. Diamond Liquid Chlorine is playing an important role in the development of this program, through the chlorination of domestic sewage and industrial wastes by industrial plants and communities.



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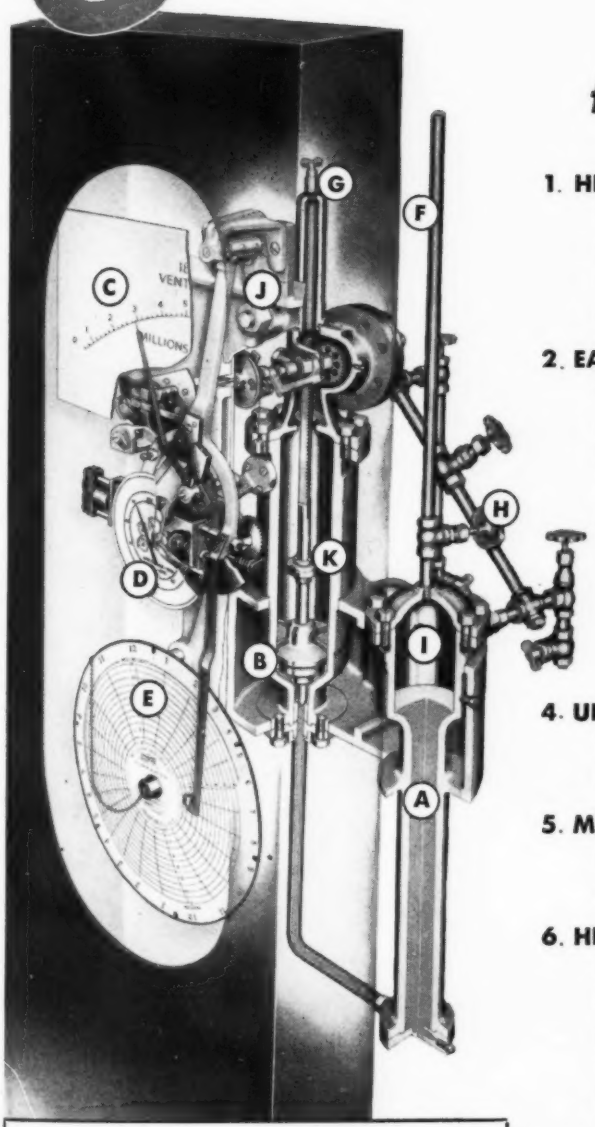
8 GOOD REASONS!

Why Builders Type M Meter Instrument is THE BEST BUY for Water and Sewage Works



1. HEAVY-DUTY "POWER PLANT":
Large wells containing 35 lbs. of mercury (A) and a solid float of 10¼ sq. in. area having a vertical travel of 4½" (B) provide the reserve power necessary for years of super-sensitive, accurate, and trouble-free operation.

2. EASY-TO-READ DIALS:
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3. BUILT-IN CALIBRATING DEVICE:
Accuracy of registration easily and quickly checked in the field by means of built-in water head test pipe (F).

4. UNAFFECTED BY TRAPPED AIR:
Trapped air has no effect on accuracy; air easily removed through a valve at the top of each well (G and H).

5. MEEHANITE IRON:
Mercury wells (I), main bracket on which mechanism and wells are mounted (J), and float (B) are high-tensile MEEHANITE iron.

6. HIGH ACCURACY — WIDE RANGE:
Registration with plus or minus 1% (response to differential induced by actual flow rate) over range of 100% to 6⅔% capacity for Model MDUA; within plus or minus ½% from 100% to 50% and within plus or minus 1% from 50% to 5% of capacity for Model MDUAX.

7. POSITIVE OVERLOAD CHECK:
Check valve (K) prevents loss of mercury even at extreme overload differentials.

8. LONG LIFE:
Type M Instruments installed over thirty-five years ago are still "going strong"!

For Bulletin D7-200, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 10 Codding Street, Providence 1, R. I.

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BUILDERS PROVIDENCE
Instruments

You wouldn't want to buy an "iron pig" in a poke!

Years ago when Disposalls* were first introduced—skeptical sanitation officials called them iron pigs.

These iron pigs would swallow garbage, officials admitted. They might even chew garbage. But could they digest it properly? Would their use result in sewer stoppages? What was there to prevent grease from clogging the lines? What about operational hazards?

It was agreed that the elimination of garbage would be a great step forward in the health and cleanliness of the community—but would the proposed method be practical, economical? Was it safe and sound?

Actually this was the line of questioning that General Electric representatives welcomed. They were eager to prove that the Disposall method was a scientifically worked out process that extended from the kitchen drain right to the sewage treatment plant—that it worked perfectly every step of the way.

That such evidence was given is shown by the nation-wide acceptance of this revolutionary method. In cities, large and small, public officials have paved the way for

the installation of Disposalls in their communities' homes. Where necessary, farsighted sanitation officials have revised sanitary codes to permit the use of this important appliance.

Yes, gentlemen, the Disposall has done more than remove germ-spreading garbage from the kitchen and back yard. It has removed the doubts of the most skeptical sanitation engineers.

Yet there still remains the danger that some new, untested garbage grinder will not fulfill the promise of this new sanitary achievement.

To protect you against buying a "pig in a poke"—to enable you to examine closely the qualifications of every food-waste shredder—General Electric turns over to you its own list of specifications.

Here, then, are the *strictest* of specifications, self-imposed by the pioneer in the field. They are the result of years of testing and experimenting with the problem of garbage elimination. They have been General Electric's guide in the development and perfection of the Disposall. They can be your guide in guarding the health, cleanliness, and economy of your community.

GENERAL ELECTRIC'S SPECIFICATIONS FOR ITS FOOD-WASTE SHREDDER—THE DISPOSALL

1. *The food-waste shredder should have a flow interlock that permits operation with cold water only.*

This is because experience has shown that only with cold water will greases become congealed within the cylinder. With congealed grease broken up into small particles, mixed with the food waste and carried off through the drain, there can be little tendency for greases to adhere to the walls of the pipe.

2. *The discharge from a food-waste shredder should always remain in a fluid state. The correct relationship between the amount of food waste and tap water should be maintained by controlled shredding.*

This permits the ready flow of effluent through traps, drain, or soil lines in a manner to prevent clogging.

3. *The food-waste shredder should shred food waste to a uniform size to meet the following requirements: 100% shall pass a ½-inch screen. At least 90% shall pass a ¼-inch screen. Not over 5% shall pass a #40 sieve.*

(Screens should be the United States standard, and weight should be taken on a dry basis.)

In other words, the particles of shredded food waste must be of a correct size to permit ready digestion at the treatment plant.

4. *The food-waste shredder should be self-scouring with no fouling surfaces.*

This will prevent objectionable odors.

5. *The food-waste shredder should be free from electrical or mechanical hazards.*

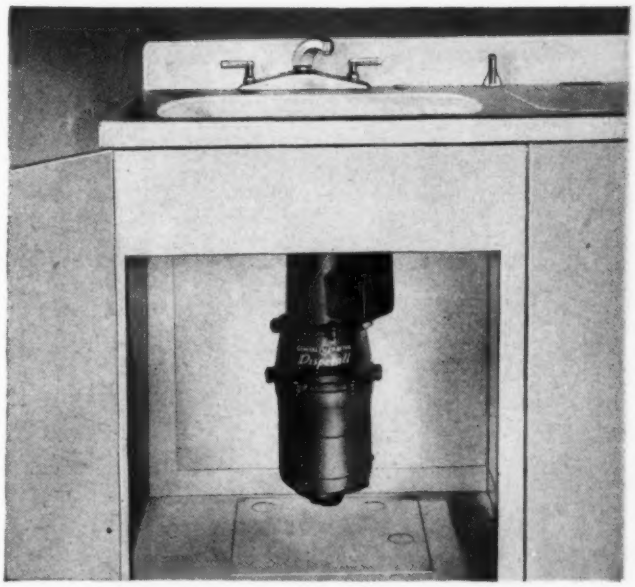
To be completely safe, the shredding compartment should be inaccessible during operation.

6. *The food-waste shredder should be permanently connected to the drain and be free from any cross-connection in accordance with the local plumbing code.*

This regulation eliminates any makeshift, homemade hookups, and assures proper operation from sink to sewage treatment plant.

• • •

For further information about the Disposall method—its economies as well as its efficiency—simply write to Department WSW 488 General Electric Company, Bridgeport 2, Connecticut.



The General Electric Disposall is easily installed in most any sink. Here it is shown installed in our Electric Sink. Food waste is scraped into drain opening, and safety cover placed in position. Cold water tap is then turned on, starting the Disposall operation. Food waste is shredded and flushed away automatically.

Disposall

*General Electric's registered trade-mark for its food-waste disposal appliance

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

GENERAL ELECTRIC

STANDARDIZE ON TRIDENT BECAUSE

TRIDENT *Interchangeability* MEANS

EFFICIENCY IN MAINTENANCE

"TRIDENT METERS ARE EASIER TO REPAIR

"It is a pleasure for me to inform you that, even tho' I am without eyesight, I have worked in the Meter Shops for Salt Lake City for a little over six years and that I find it easier to repair TRIDENT Water Meters than any other make with which we come in contact."

Statement by MR. HUBERT COCHRAN

EFFICIENCY experts will tell you that lost motion is one of the major causes of inefficiency. An example of this, in a meter shop, is the time and effort spent in finding the proper repair parts, and scraping and fitting them at the bench.

Interchangeability is the cure for both these ills; and you get it in Trident Meters. Standard new parts fit all casings, new or old, perfectly.

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WATER & SEWAGE WORKS

VOL. 95, NO. 8 AUGUST, 1948

A Gillette Publication

COPPER SULPHATE AIDS SEWER MAINTENANCE AND SEWAGE TREATMENT

by
JOHN W. HOOD
Superintendent,
SEWAGE TREATMENT
RIDGEWOOD, N. J.

SINCE the original article on this subject appeared in the March 1942 issue of *Water & Sewage Works*, many requests for supplemental information have been received by the author from city, town and state officials in the United States, Canada and South America. These correspondents included state departments of health and city engineers; foresters; city managers, mayors and commissioners; arborists; restaurateurs; superintendents of public works, sewerage systems and sewage treatment plants; and private citizens. These letters denote the widespread interest in the subject matter, and reveal the extent to which this problem of root infiltration had made itself known.

It is superfluous to state that the interest was not in the roots themselves, but in the sanitary, economic, and aesthetic problems created by their infiltration. Private citizens and public officials are frequently found apathetic to proposed root control programs, the exceptions being invariably those who have already had experience with flooded cellars and interrupted sewer service.

Reasons for Root Removal

In addition to the home owner's problem, which stems from the obstruction of sanitary sewer service pipes, there are others which although not so generally appreciated, are of equal or greater concern. These include deterioration of sewers and appurtenances such as manholes and underground structures, sewage treatment plant units and mechanisms, odor nuisances, sewage purification difficulties, inadequate treatment and enhanced costs.

The Author

It should be understood, however, that tree roots are not exclusively responsible for production of malodors. Sludge deposits and slimes in sewers are also responsible for objectionable odors.

The benefits to be derived from the use of copper sulphate in sewers and house connection pipes based upon a decade of experience at Ridgewood are as follows.

1. Odor control in the collection system and plant.
2. Reduction in chlorine requirements.
3. Improved and more economical treatment at plant.
4. Root removal and elimination of unsanitary stoppages.
5. Clean sewers free from obstructions that reduce carrying capacity.
6. Clean force mains, enabling pumps to maintain capacity and efficiency.

Explanatory

In order to understand how tree roots in sewers can cause the impairment of structures and destroy the efficiency of purification processes, it is first necessary to consider the character of the sewage passing through the pipes. Sewage has been defined as a heterogeneous collection of inert and decomposable waste matter, soluble and insoluble, dispersed in large volumes of water. Unlike clean water, sewage is a dynamic semi-liquid, constantly undergoing change.

Collection systems are designed to promptly convey this semi-liquid in a "fresh" condition from homes and other points of origin, to the treatment plant. Here the liquid and solids are segregated and treated in separate structures by different processes, the liquid undergoing oxidation (aerobic decomposition) and the solids, digestion or reduction (anaerobic decomposition).

The purified liquid flows to a receiving stream and the dewatered residue from the digested solids may be used as fertilizer or fill. When a root mass obstructs a sewer pipe, the solids are retained on the upstream side, while the filtrate seeps through the mass. This condition affords an ample structure within which the evolution of anaerobic life and activity is established, favorable factors being little or no atmospheric oxygen such as would normally be present in an unobstructed and therefore well ventilated sewer; a warm liquid media and a

constant supply of food in the form of decomposable organic matter.

Micro-biological processes such as occur in soil, convert the waste matter to simple dissolved state, thus making it available as food for the tree roots to draw on. This condition may prevail for a long time before a complete stoppage reveals its existence. Meanwhile, the "fresh" semi-liquid from the homes is being transformed into a highly decomposed and offensive condition even before it leaves the house connection pipe. Not only is the scouring action destroyed but the septic conditions created in the sewage are conducive to further biochemical change, productive of further "reduction" (loss of oxygen) attended by malodors and extensive filamentous fungi growths.

The presence or absence of oxygen in water dictates in a large measure, its freshness or staleness. In the case of sewage, it is extremely important to maintain "fresh" conditions, not only for odor prevention, but also to ensure the integrity of structures and subsequent effective and economical purification, either by biological oxidation or chemical treatment processes. The process of reduction is diametrically opposed to the oxidation process employed at the plant to purify the liquid sewage and may preclude satisfactory treatment results.

Sulphuretted hydrogen odors, sewerage systems and sewage treatment plants have been closely associated in the public mind for so long, that they are accepted as a somewhat inevitable combination.

Fuller[1] states "There is no known way of preventing the formation of H_2S which is released from organic sewage matters by a great variety and perhaps most kinds of bacteria . . . in the event that it is true that there are but very few species of bacteria capable of producing H_2S through the reduction of the mineral sulphates, it may be feasible to find some way to destroy such growths. It would be better yet to find some means of preventing such growths from becoming seeded in works, on account of the importance of guarding against the resulting solvent actions that disintegrate masonry and metal structures . . . . ."

Root Removal

The general practice is to employ some mechanical means to cut and remove the offending roots after their presence has been disclosed by sewer stoppage. Due to the size of root stems and damage to vitrified pipe hubs or bells, caused by lateral expansion during growth, it is frequently found necessary to dig up and re-lay the connection. This is a costly and messy procedure and cases on record show that this is no guarantee of freedom from further trouble. As a last resort, many valuable trees have been cut down in order to maintain sewer service uninterrupted.

One eastern city forester reported having "60,000 shade trees, 25 to 50 years old, growing along 500 miles of streets. The number of requests for tree removals as the result of sewer lateral stoppage is overwhelming, sometimes as many as ten a day. We have removed a large number of trees in order to relieve this condition, but it is a physical impossibility to comply with even a small percentage of requests, and we do not like to remove otherwise fine trees. However, when the plumbers' bills mount up, the citizens demand action."

NOTICE

Village of Ridgewood

Department of Sewers

Obstruction of sanitary house connection pipes by root growths is responsible for the interruption of sewer service and the attendant unsanitary conditions.

Considerable expense is also incurred by the Property Owner and the Village at large, in removing these obstructions.

Owing to the increasing number of these undesirable stoppages occurring throughout the Village, preventive measures have been developed to destroy these growths.

An employe of this Department will call on you in the near future. His work requires only a few minutes and your cooperation is respectfully requested.

Albert J. Faber,
Commissioner of Public Works.

Space does not permit a complete review of all the interesting and revealing facts contributed by correspondents. Most cities revealed that the problem of root control was on an emergency basis. Prior to 1936, Ridgewood, N.J., was no exception, obstruction of sewer mains and house connections being all too frequent occurences.

Foul odor conditions prevailed the year around at the Sewage Treatment Plant, and concomitant disintegration of concrete structures had progressed to the extent that some structure walls were "razor backed" and were rebuilt by the Gunite method. Chlorine demand and costs were high and very poor results were being obtained from the biological oxidation process.

Chemical precipitation was a feature of the 1936 reconstruction program. Major difficulties encountered in operating this treatment process prompted a thorough investigation which ultimately revealed that the tree roots were primarily responsible and should be brought under control.

Copper sulphate (blue vitriol) is used extensively by the water treatment industry for the control and elimination of taste and odor producing microscopic organisms and undesirable aquatic plant growths.

Since efforts to dislodge the extensive growth of fungus in the sewer system by the application of chlorine had proved uneconomical and unsuccessful, the use of copper sulphate was next considered. Microscopic examinations showed Beggiatoa was the predominating species of fungus present.

Hale[2] indicated that a minimum concentration of 5 ppm. was necessary for the eradication of this species.

About two pounds medium size crystals were sprinkled along the exposed pipe inverts of intersection and terminal manholes throughout the sewer system, this work being performed from the street level. Two barrels (total 800 lb.) copper sulphate were thus applied to the system over a period of several days. Subsequent to this application some pipes were found literally full of the dislodged fungus growth being carried along in the flow. As a result of this preliminary treatment, odors were reduced to such extent that up-sewer chlorination was discontinued and the need for prechlorination at the plant for odor control, confined to a few summer months. Dislodged root masses were observed in the plant influent from time to time and stoppages in the sewer mains became less frequent.

The annual application of $CuSO_4$ to the system has been an established practice at Ridgewood, N.J., since 1937. A hand bill was prepared for distribution to residents, to pave the way for $CuSO_4$ work on the house connections from within the homes, since these pipes were found to be in worse condition than the mains in the streets.

Two or three pounds of crystals are applied through the commode and flushed outside the cellar soil pipe system. This program has been accelerated by the recent assignment of an

employee to this work exclusively. Pre-chlorination for odor control is now unnecessary, even during summer months. Sewage is "fresher" and therefore more amenable to treatment by biological oxidation. This is reflected in improved effluent quality, despite increased population load on original trickling filter unit.

House Connections

Several connections whose outlets were available for sampling were selected from a sewer map. They were located in sandy terrain and it was not unexpected that the owners, when approached for permission to experiment, readily granted the desired permission and told of repeated sewer trouble and plumber bills.

The property owner was informed of our intention to use copper sulphate and it was specially emphasized that $CuSO_4$ had no magic qualities; that it merely had a toxic property capable of killing live roots which would in time break loose or disintegrate and be swept out by the flow of sewage. It was also emphasized that these root growths within the pipe were of 10-, 15-, 20-year standing; that we had no way in which to ascertain the extent of their infiltration and the amount of copper sulphate which would be necessary to kill them all.

Success crowned these efforts and a comparison of analyses made before and after the copper treatment showed that in all cases the pH-Alkalinity equilibrium had declined. When subsequent determinations disclosed a calcium carbonate equilibrium more nearly resembling the city water, the connection was considered clear and no further treatment given.

Results Noted

A short street of seventeen homes having a bad record of sewer stoppage due to roots was next tackled. After several weeks the determination showed a decline in equilibrium from pH 7.9 and alkalinity of 435 ppm. to pH 7.7 and alkalinity of 227 parts. It is important to state that before the copper treatment of house connections in this street, the sewage was not responsive to any dose of chemical coagulant, whereas afterwards it was found to be amenable to chemical clarification with much smaller doses of chemicals than had been previously tried.

When a year had elapsed from the completion of work on this street, each connection was gone over with sewer cleaning equipment. All connections were found clean and clear, no roots being brought out by the equipment.

Since the extent of the root growth in any given pipe is unknown, a greater or lesser amount of the crystals may be required to permeate the whole mass.

An individual root mass entering at one point may clog a pipe or connection just as effectively as half a dozen, but obviously more crystals would be necessary for the greater quantity of roots.

Property owners and occupants furnish "case histories" by relating their woes with their sanitary connections, and the extent of the root growth may be deduced from their statements.

House Connections

As previously stated, crystals are applied through the commode within the home. The operator carries a container of crystals and puts two or three pounds through each connection. Where serious trouble and recurrent plumber visits have been experienced by the tenant, initial doses of six to ten pounds have been applied in an attempt to insure complete contact, and such cases have been marked down for repeat doses at weekly, fortnightly or monthly intervals, as the conditions seem to dictate. After the initial high dose, and in the absence of any further clogging troubles, normal low doses of crystals may be used.

When a connection is completely plugged and overflowing, rodding must be resorted to to restore flow through the root masses. Thereafter copper sulphate crystals may be applied, but not before. There has to be some flow through the connection in order to carry the solution down through the roots for the attack.

Street Sewer Mains

A light truck and a barrel of copper sulphate crystals are the operator's tools. Junction and terminal manholes are opened, a small scoopful of crystals are sprinkled along the invert of the pipe, and the manhole cover replaced. Thereafter the flow gradually dissolves the crystals and the resulting solution contacts roots and fungi as it flows down stream. About two pounds per manhole is applied, but here again this amount is increased as in the case of the house connections, when records indicate serious root trouble.

Under no circumstances should an amount of crystals sufficient to obstruct the flow be placed in the inverts, nor should crystals be placed in the traps of automatic siphon type flush tanks. In the first place, they will not dissolve due to the absence of flowing water, and secondly, they may tend to corrode the metal.

It is recommended that periods of normal to low flow be chosen to introduce the copper sulphate. Both the time of contact and the concentration of the solution are thereby enhanced. A preventative dosage may be given annually following the initial treatment. Old roots do not return, but new root infiltrations may develop.

Careful records of all work should be kept so that not only will the results be disclosed, but eventually all of the system and house connections may be serviced.

Some Important Don'ts

Don't put $CuSO_4$ crystals in fixture traps. Corrosion by interchange of metallic ions will occur and eventually eat holes in the traps. Flush the crystals through the commodes when applying from within homes, and follow with a sufficient amount of flushing water to insure (1) their transit through the soil pipe to beyond the cellar wall and (2) their conveyance to and against the root obstruction, where the crystals will dissolve, discharging the solution slowly into the root mass.

Don't expect black magic properties from $CuSO_4$. Remember that a good root mass is well-nigh impervious to concentrated sulphuric acid. Only the life is taken by copper sulphate treatment and thereafter the normal processes of decay must ensue.

Don't waste $CuSO_4$ in the system during periods of high flow. The dilution factor is too great and the resulting concentration of the solution too weak to be effective. Pick low-flow periods.

Don't expect $CuSO_4$ to clean sewers and house connections mechanically obstructed by breakage, bad connections or faked bends. The amount used on a system in any given time should be arrived at by collaboration with the plant superintendent, who is best able to determine what the traffic will stand, by close observation of the biological and/or chemical processes incorporated in the plant.

References

(1) Fuller, G. W. "Sewage Disposal"

(2) Hale, Frank E. "The Use of Copper Sulphate in Control of Microscopic Organisms"

SEWER INSPECTION DE LUXE

Four Miles by Jeeps Through Queen's New $10,000,000 Sewer

No. 1 Jeep

Ready to be lowered away into Corridor Sewer. Close-up of occupants on right.

Brass Hats

Wm. Raisch, Borough Cons. Engr.; Jas. A. Burke, Borough President; Wm. H. Bertram, Borough Sewer Engr. (*At the wheel)*

Fifty borough officials, engineers, editors and reporters were given a look inside of a new storm sewer draining 63,000 acres in the Borough of Queens, New York City, which is nearing completion at a cost of $10,000,000. In addition Queens has under construction additional sewers which will cost another $10,000,000.

Classified as "must construction" these sewers have been rushed to completion in order that several important housing developments and much needed construction of more than 75,000 houses might proceed on what heretofore has been marshy land.

The inspection trip de luxe through four miles of the great Corridor Sewer was made in a unique manner. Twelve (possibly fifteen) jeeps were lowered by crane into the sewer near its outlet (see picture), and the caravan proceeded up-sewer a distance of four miles, carrying the 50 officials and guests who saw an example of excellent water-tight concrete construction within ground water for about two miles. At the end of the ride the party emerged via ladder through a manhole to inspect the Fresh Meadows housing project of the N.Y. Life Insurance Co., now nearing completion, to house 11,000 people in a self-contained community.

Some idea of the capacity and importance of the Corridor Sewer can be had when it is noted that at the lower end it has 3 barrels 16 ft. x 10 ft. each. As Borough Consulting Engineer, Wm. Raisch is responsible for design and construction of Queen's $20,000,000 sewer building program. Wm. H. Bertram is Borough Sewer Engineer in charge of construction.

Bureau of Standards Underground Corrosion Studies Completed

Specimens on Display; Report in Preparation

In connection with field tests of the corrosion resistance of various pipe materials in different types of soils, the National Bureau of Standards announces an exhibit of approximately 3,000 test specimens.

The specimens were exposed at 15 selected sites over the country for periods ranging from 5 to 14 years. Included were 85 varieties of materials, including wrought iron and wrought alloys, cast iron and cast alloys, steel and steel alloys, copper and copper alloys and miscellaneous samples of zinc, lead, metallic and non-metallic coated pipe, and asbestos-cement pipe. Loss of weight and depth of pitting of the samples have been measured, and a report on the findings is in preparation.

Chemists, metallurgists, corrosion engineers, and others interested in the behavior of materials underground are invited to inspect the actual samples—on display at the Bureau's underground corrosion laboratory, Connecticut Avenue and Van Ness Street, N.W., Washington.

Whether the report in preparation is to be sold through the U.S. Gov't Printing Office or distributed gratis by the Bureau is not known, but all interested in the results of this important study would do well to let the Bureau of Standards know in advance the number of copies of the report which are desired.

$8,000,000 for South American Water Supplies Being Loaned by Export-Import Bank

Quito, the capital city, and Guayquil, Ecuador, are to have modern water supply systems at an estimated cost of $4,000,000 each.

The $8,000,000 needed is being loaned by the Export-Import Bank, these loans being guaranteed by the National Government of Ecuador.

Plans and specifications covering the two projects are subject to approval of the Bank.

CENTRAL STATES S.W. ASSN. 21st ANNUAL CONVENTION

Milwaukee Meeting Attendance Breaks Record

MEETING in Milwaukee, Wisconsin, for the first time in many years, the Central States Sewage Works Association held its 21st Annual Convention on June 18 and 19. A record-breaking attendance of 211 persons registered for the meeting, which was held in the Hotel Schroeder. Included in the program were not only a number of technical papers for panel discussion and an operators' breakfast discussion, but also for the ladies a luncheon and style show, a talk on interior decorating, and Russian tea. The meeting ended on Saturday afternoon with an inspection of the Milwaukee Sewage Treatment Works. The annual banquet was addressed by Dr. W. B. Hass, Chem. Dept., Purdue Univ.

Presidents

Incoming	Outgoing
Carl B. Carpenter	*H. G. Rogers*
Superintendent	*St. Dept. Health*
Hammond, Ind.	*Minneapolis, Minn.*

Business Meeting

At the annual business session, conducted during the luncheon on Saturday, the following officers were elected to serve for the ensuing term of office:

President
Carl B. Carpenter, Supt.
Sanitary District, Hammond, Ind.

1st Vice President
Leon S. Kraus, Chemist,
Sewage Treatment Plant, Peoria, Ill.

2nd Vice President
H. T. Rudgal, Supt.
Water & Sewage Works,
Kenosha, Wis.

3rd Vice President
M. L. Robins, Chemist,
Minneapolis-St. Paul Sanitary District

Secretary-Treasurer
Paul W. Reed, San. Engr.
State Dept. of Health,
Indianapolis

Federation Director
(3-year term)
George W. Martin, Supt.
Metropolitan Sanitary District,
Green Bay, Wis.

Awards

The annual Gus Radebaugh Award of the Central States Sewage Works Association was presented to A. F. Bartsch, Senior Biologist, State Committee on Water Pollution, Madison, Wis., for his paper on "Biological Aspects of Stream Pollution," which was published in the March, 1948 issue of *Sewage Works Journal*.

At the annual banquet, presentation of Federation Awards was made by George S. Russell, President of the Federation. These were the awards which were announced at the annual meeting of the Federation in San Francisco in July, 1947. They were as follows:

Vice Presidents

First	Second
L. S. Kraus	*H. T. Rudgal*
Chemist	*Supt.*
Peoria San. Dist.	*Water & Sewage*
Peoria, Ill.	*Kenosha, Wisc.*

(Third V. P. is M. L. Robins, Chem. Minneapolis-St. Paul San. Dist.)

The Emerson Medal to Langdon Pearse, Sanitary Engineer of the Chicago Sanitary District, Chicago, Illinois.

The Hatfield Award for an Operator's Report in a large community to George J. Schroepfer, Prof. of San. Eng., Univ. of Minnesota and former superintendent, Minneapolis-St. Paul, and Lauren H. Sleeger, Chemist, Minneapolis-St. Paul Sanitary District.

The Hatfield Award for an Operator's Report in cities of less than 10,000 population was made to F. E. Peterson, City Engineer, Belvidere, Illinois.

The Gascoigne Award was made to Leon S. Kraus, Chemist, Peoria Sanitary District.

The Federation Executive Secretary, W. H. Wisely, also made the presentation of the "Man-Miles" Award, which has, in the past, been given annually to the member association of the Federation whose members have traveled the most man-miles to attend the convention. Since the Central States Association has won the first award three times running and this second award three times running, the award has been discontinued.

Heat Exchangers

The first technical session was opened with the presentation of a talk on "SLUDGE DIGESTION EXPERIENCES WITH THE EXTERIOR HEAT EXCHANGER," by Walter M. Kunsch, Engineer-Manager, Champaign-Urbana Sanitary District, Urbana, Illinois. Mr. Kunsch showed photographs of the installation and presented diagrams and data on its operation; the heat exchanger having been installed in April, 1946. He described the unit; its heating cost; temperature control; safety controls; and automatic protection against excessive boiler temperatures, pilot failures, gas failure and return; and power failure. This particular unit consumes 480 cu. ft. of gas per hour and produces 310,000 Btu. per hour for normal operation on a gas of 650 Btu. per cu. ft. The maximum burning capacity is 675 cu. ft. per hr.

Federation Directors

Incoming	Outgoing
George W. Martin	*C. C. Larson*
Superintendent	*Chemist*
Metrop. San. Dist.	*Sanitary Dist.*
Green Bay, Wis.	*Springfield, Ill.*

Besides the unit itself, Mr. Kunsch described the auxiliary equipment, and the digestion tank with which the unit is connected. At the Champaign-Urbana Sanitary District, there are Imhoff tanks, which receive 60 per cent of the sludge solid load and a separate sludge digestion tank which receives 40 per cent of the total load. In this particular installation, the sludge digestion tank was up to full operation on gas, within one month after the start of the operation. 38,000 gallons of seed sludge were used to start the tank. By use of the external heat exchanger, temperature of tank is maintained at 95 deg. F. plus or minus ½ degree. The upper limit of the water bath in the exchanger is 180 deg. and the output of the exchanger is varied according to the outdoor temperature and the pumping of sludge.

Programmers

H. O. Halvorson
Prof. Bact.
Univ. of Minn.
Minneapolis

W. M. Kunsch
Engr. Mgr.
Sanitary Dist.
Urbana-Champaign
Ill.

Mr. Kunsch pointed out that the temperature rise of the re-circulated liquor through the exchanger depends on the rate of flow and the gas consumption. The operation of this exchanger is checked once every four hours by the operator. The cost of operation is comparable to other methods of heating. At this particular plant, the power required costs approximately $1.25 a day, or $450.00 a year.

This unit, which has completely accessible parts, has given no mechanical trouble. In the early operation, pilot light failures were occasional because of clogged needle valve. There has been no caking of the coils in 26 months. The heat in the digestion tank has been uniform, even in the coldest weather, due apparently to the excellent recirculation obtained through the equipment.

In order that the listener might evaluate in his mind the operation of this heat exchanger, with reference to plant load and operating conditions, Mr. Kunsch gave the following information: The supernatant liquor which is pumped back through the heat exchanger, contains approximately 2 per cent total dry solids. The raw sludge load on the plant is 2.75 lb. per cu. ft. per month or 2.1 lb. of volatile matter per cu. ft. per month. The gas produced from the tank amounts to 12.5 cu. ft. per lb. of volatile matter digested or equivalent to 1.14 cu. ft. of gas per capita per day. The volatile matter is reduced by 80 per cent and the total solids are reduced by 66.6 per cent. The gas production from the digestion tank amounts to 15.6 cu. ft. of gas per square foot of surface per day. It is this high gas rate, Mr. Kunsch says, which keeps the total solids content of the supernatant liquor high. When the gas production rate drops below 12 cu. ft. per square foot of surface per day, the supernatant liquor improves.

Mr. Kunsch believes that the external heat exchanger is the answer to heating coil problems. In addition, there are other benefits derived, such as improved digestion, improved gasification, and the elimination of the scum problem. The cost of operation may be slightly more than that for internal heating coils. The time of digestion is about the same.

As to the high total solids in the supernatant liquor, Mr. Kunsch believes that a second stage digester, in series, will overcome this problem.

Chemical Conditioning Undigested Sludge

H. O. Halvorson, Prof. of Bacteriology, University of Minnesota, Minneapolis, Minn., spoke on the subject of "CHEMICAL CONDITIONING OF UNDIGESTED SEWAGE SLUDGE." This work was motivated by a desire to handle solids without digestion, in order to hold the nitrogen in the solids and out of the liquor. This, Prof. Halvorson points out, has been done in large plants by vacuum filters, but it has not been done in small plants. Raw sludge cannot be dried on sand beds, and it was therefore the desire to find some way of conditioning raw sludge in order to allow sand bed drying.

Secy.-Treas.
Paul W. Reed
San. Engr.
Ind. Dept. Health
Indianapolis, Ind.

Local Arrange.
R. T. Steindorf
Proc. Eg. Div.
Chain Belt Co.
Milwaukee

The procedure followed for conditioning the sludge for sand bed drying was to add ferric chloride to the raw sludge, and mix for 20 to 30 seconds, with a lightning mixer. The end point is determined by a change in color of the sludge from a dark to a light brown. After this very short period of mixing of the ferric chloride and the sludge, the material is drawn to the sand bed. The carbon dioxide gas, which is evolved when ferric chloride is added to the alkaline sludge, keeps the solids floating and allows the water to drain off. Within six to eight hours, the sludge is sufficiently dry and firm to be forked.

Programmers

F. B. Strandskov
Bacteriologist
W. & T. Res. Labs
Newark, N.J.

C. A. Stravinski
San. Engr. Labs
Univ. of Wisc.
Madison, Wisc.

The amount of ferric chloride needed is based on 1½ to 2 lb. of ferric chloride per 100 gal. of sludge. On a dry solids basis, this amounts to 6 to 8 lb. of ferric chloride to 100 lb. of dry solids. In a town of 1,400, 14 lb. of ferric chloride are used per day. This costs less than $1.00 a day or less than $300.00 a year.

Prof. Halvorson showed pictures of Cokato, Minnesota ("The House by the Side of the Road"; see *Water Works and Sewerage*, Feb. 1943), where treatment is effective, the raw sludge being reduced to 80 per cent moisture, having no odor and a pH of 3 to 3.5. The bacterial kill in this sludge amounts to 90 to 95 per cent, but it must be borne in mind that this is not sterilization and the number of bacteria left are still enormous. If 10 per cent of the ferric chloride is replaced with copper sulphate, a 99 per cent kill of bacteria is obtained. This, still, is not sterilization and the sludge, as removed, should not be used on truck gardens. It may be used on farms or spread in small piles for aging over the winter season. No odor is evident from the sludge so disposed of.

In one instance, Prof. Halvorson tried a small vacuum filter. If care

was taken to avoid digestion of the sludge solids or incipient digestion of the sludge solids, vacuum filtration worked very well. The sludge is stored in tanks for periods up to four months, without heating, and practically no digestion occurs. At the end of that period, however, the storage tanks must be completely cleaned and washed out in order to remove the seeded sludge, which might cause the digestion of further additions thereafter. At this particular plant, 2 per cent ferric chloride and 7 per cent lime were added, based on the dry solids content. The moisture content of the cake after filtration was 65 per cent.

This sludge cake was dumped on land used for farm cropping and distributed on unused land in the summer, or allowed to pile up for distribution during the winter. The cost for chemicals amounted to $250.00 a year, for this town of 6,000 persons, where a creamery adds another 6,000 population equivalent. Filter cloths must be washed at the end of each weekly use and they last very well. Filtering is done for one week out of each month, operating on an 8-hour day schedule. The longest time the sludge can be stored is four months and there must not be any digestion taking place, because partially digested sludge gives trouble on the vacuum filter and causes a thin cake. The nitrogen content of the sludge runs from 3 to 7 per cent.

Milk Panel

T. F. Wisnicwski
San. Engr.
St. Bd. Health
Madison, Wis.

D. E. Bloodgood
Prof. San. Engr.
Purdue Univ.
Lafayette, Ind.

In the question period which followed, Walter Sperry of Aurora, Illinois, asked about the use of alum to which Prof. Halvorson replied that the addition of alum in place of ferric chloride was difficult to control, because there was no visual end point.

KENNETH MICK, Supt., Minneapolis-St. Paul Sanitary District, raised the question of the public health aspect of distributing these raw sludges on farms, even in winter. Water run off to water-courses might be affected, according to Mr. Mick. Professor Halvorson replied that heat-drying was satisfactory, but that the potential health hazard existed in both raw and digested sludge, when distributed on farms. He believes this needs further study.

Sewage Chlorination

"DEVELOPMENT IN SEWAGE CHLORINATION" was the title of the paper presented by Frede B. Strandskov from the paper prepared by himself, Henry C. Marks and Donn H. Horchler, Research Department, Wallace & Tiernan, Newark, N.J. Mr. Strandskov said that studies had shown that there is some bactericidal substance in chlorinated sewage, which kills bacteria, but that it can not be chloramines. Extending these studies to determine what this bactericidal substance was, it was discovered that the ortho-tolidine method for determining residual chlorine was not accurate in sewage. The investigators developed a new method for determining residual chlorine by titration with phenyl arsene oxide; using this new method, and comparing it with the old ortho-tolidine method, the authors tested the chlorination effects, after various contact times and at different chlorine dosages. Bacterial determinations for the coliform group were made on sewage from several different sewage plants. The ortho-tolidine test showed much lower residual chlorine content than did the new phenyl arsene oxide test. As a result, it would appear that where residual chlorine is apparently absent in chlorinated sewage, as determined by the ortho-tolidine method, there is actually residual chlorine present, as determined by this new titration method. While certain chloramines do affect this test, it is believed that the test is practically specific for residual chlorines and that it is accurate, whereas the ortho-tolidine test is not accurate as sewage determination. Mr. Strandskov concluded with the opinion that there is now a method available for control of pre-chlorination in sewage treatment.

Activated Sludge for Packing House Waste

"PACKING HOUSE WASTE TREATMENT BY THE ACTIVATED SLUDGE PROCESS" was studied at the laboratory of Hydraulic and Sanitary Engineering at the University of Wisconsin, Madison, Wis., by C. A. Stravinski, W. L. Lee and G. A. Kohlich. Mr. Stravinski reported on the results of these studies in a paper presented at this meeting. In this paper, the authors reviewed the processes used for the treatment of packing house waste, including chemical precipitation, biological treatment, and the use of chlorine for the reduction of B.O.D. The strength of packing house waste varies, as does the volume, from different packing plants and different locations in a single packing plant. Most of the wastes are high in proteins and suspended solids and average at least 900 ppm. of B.O.D.

Previous information had indicated that trickling filters and activated sludge would reduce the strength of packing house waste by as much as 95 per cent and that chlorination would reduce it by 90 percent. In these experiments, the authors developed a new activated sludge floc by special decanting, aerating, and seeding processes. To this special floc was added weak waste from one of the packing plants in Madison, Wis. The wastes were fed and aerated for five hours, after which tests were run and the activated sludge floc allowed to stand for 19 hours with aeration until the next day's feeding. The data showed that, with this five hour aeration, and 19 hour re-aeration, ammonia and organic nitrogen decreased and nitrate nitrogen went up. A high degree of purity was obtained with good nitrification. When the strong waste was treated similarly, the results were less satisfactory. The decrease in B.O.D. was not as great, nor was the nitrification as great.

Programmers

A. J. Steffen
San. Engr.
Wilson & Co.
Chicago, Ill.

W. W. Mathews
Superintendent
San. District
Gary, Ind.

Following the presentation of the paper, considerable audience participation in the discussion was evidenced. DR. F. W. MOHLMAN of Chicago pointed out that these tests were quite similar to some that had been run in his laboratories 25 years ago. He also added that the strong, undiluted waste is not too easily treated and suggests that, for the proper treatment of packing house waste, a roughing filter should first be used, followed by an activated sludge process. DR. W. D. HATFIELD of Decatur, Ill., pointed out that these data were for a five-hour feeding period and 19-hour reaeration period and therefore the results and conclusions should not be

transferred to plant practice where the addition of waste is for considerably longer periods of time and re-aeration of the sludge is often not possible.

Milk Waste

A panel discussion on milk waste was presided over by T. F. WISNIEWSKI, San. Engr., State Department of Health, Madison, Wis. Discussion leaders participating in the panel were Don E. Bloodgood, Prof. Sanitary Engineering, Purdue University, Frank J. McKee, Kraft Cheese Company, Prospect Heights, Ill., A. J. Steffen, San. Engr. Wilson and Company, Packers, Chicago, and R. W. Heider, San. Engr., State Board of Health, Indianapolis, Ind.

In introducing the subject, Mr. Wisniewski pointed out that it is estimated that, of 120 billion pounds of milk produced per year, 2.4 million pounds are lost to waste. This milk waste loss has a B.O.D. of 240 million pounds, or 700,000 lbs. per day. The value of this milk waste totals $108 million a year at current prices. Of this loss, Mr. Wisniewski believes one-half can be saved by proper plant operation, cleaning and save-all devices.

First speaker on the panel discussion was A. J. STEFFEN, who said that, "By means of good housekeeping and waste saving practices, waste should be reduced to the irreducible minimum in volume and in strength." For sanitary engineers to advise milk plants, they must know about milk equipment, before they can introduce waste-saving ideas.

Mr. Steffen mentioned that there are two means of reducing waste—those by waste-saving devices, and those that improve the procedures and clean-ups. Under the first group of devices and appurtenances for saving waste are included the following: drip catchers, liquid level controls, entrainment separators for vacuum breakers to prevent flash carry-overs, piping arrangements that permit drainage, pumps of the proper capacity to handle peak loads, adequate temperature controls and stand-by power supply.

Among the procedures for improving clean-ups, which is something that must be sold to management of milk plants, Mr. Steffen mentioned the following: joint leakage, prevention of over-filling cheese vats, overflow pipes of sufficient capacity, pre-rinse of vats, with the catching of the rinsings, sweeping up of dry milk solids.

In reference to waste sources from both operation and clean-up, FRANK MCKEE pointed to losses in can washes which can be reduced from one gallon to one pint per can by the means of re-circulation. About four ounces of milk is left in each can and 75 per cent of this can be collected and prevented from going to waste. The drip collection alone will save two ounces, and reduce the B.O.D. since the waste is 7 lb. per 10,000 lbs. of milk. Where waste water is included with clean water, it is economical to separate them and re-evaporation of evaporator rinses is feasible. Mr. McKee also spoke on the problems of sampling and of properly determining the B.O.D. He pointed to the need for a chemical oxygen demand test.

Banquet Speakers

G. S. Russell
Pres. F.S.W.A.
St. Louis, Mo.

W. H. Wisely
Secy. F.S.W.A.
Champaign, Ill.

R. W. HEIDER spoke on milk waste treatment methods, pointing out that these methods must consider the receiving water. Waste may go to municipal sewage systems or to private waste disposal. If private waste disposal is used, there should be holding tanks for equalizing the discharge. These may be followed by a septic tank and soil absorption, or by standard trickling filters, high-rate trickling filters, or by activated sludge.

Mr. Heider said that trickling filters, either standard or high-rate, were used to the greatest extent, but that other methods worked, if carefully operated, especially if holding tanks were installed.

PROF. DON E. BLOODGOOD of Purdue spoke on the problems in treating milk waste in municipal plants. Difficulties arise because the milk waste is quite strong, 8 millimeters of milk waste being equivalent to one gallon of sewage. Whey is half as strong as whole milk. Butter fat is three times as strong as whey. Milk waste, according to Prof. Bloodgood, often gets the blame for improper operation of a municipal sewage treatment works, but milk waste can be treated by any process for sewage treatment. It should be borne in mind, however, said Prof. Bloodgood, that you cannot build a municipal plant large enough to handle the milk waste. He suggests that sewer rentals, when adopted more generally, will force milk plants to recovery of wastes because they cannot afford to pay for the treatment. He suggests that the industry can find ways to cut the waste loads in half.

During the discussion, R. T. RICHARDS of Chicago asked about the application of chemical treatment methods, Mr. Wisniewski replied that these worked, but were not applicable and Mr. McKee said that in the case of the Guggenheim Process, it had been found to be expensive and not too efficient.

STANLEY BARKER of the New York State Department of Health raised the question as to the application of the Mallory oxidized sludge process in use at Zeeland, Michigan. W. F. Shepherd of the Michigan State Department of Health replied that Zeeland's plant worked well for three years and reduced the B.O.D. from 900 to 2500 down to 9 to 11. Thereafter, the load increased from the milk plant and the digestive structure had a partial failure with the result that the B.O.D. of the effluent increased from 100 to 200 parts per million level. After the Meade-Johnson Co. had increased the capacity of the treatment plants, the effluent B.O.D. was improved and is now about 20 to 25 parts per million. In reply to further questioning, Mr. Shepherd said that the method of treatment is expensive, but probably no more expensive than other types of treatment. This treatment was installed for concentrated whey, which is stronger than wastes from milk plants where the whey is utilized.

Further discussion on the subject of whey and its strength and disposition brought out the fact that better testing methods are needed and also the fact that at Marion, Ind., David Backmeyer adds the whey directly to the sludge digestion tanks, a process which works very well.

The use of detergents in treatment works or milk plants has been very effective, but the speakers warned that too much detergent should not be used, or it could affect the treatment of the waste. In reply to a question by H. E. SCHLENZ of the Pacific Flush-Tank Co., Chicago, the panel was agreed that if the waste from a milk plant was discharged over a period of 8 hours, the treatment works should be built on the basis of a 24-hour capacity, that is, three times the 8-hour discharge.

OPERATORS' BREAKFAST

The annual operators' breakfast was held with L. S. KRAUS, Chemist, Peoria Sanitary District, Peoria, Ill., presiding. Among the board of experts on the panel were H. T. Rudgal, Supt. Water and Sewage, Kenosha, Wis., Walter Kunsch, Engineer-Manager, Champaign-Urbana Sanitary District, W. W. Matthews, Supt. of Sewage Treatment, Gary, Ind.

Mr. Kraus opened the session by asking the question, "What is the object of sludge digestion?" Mr. Kraus answered the question himself, adding that, after considerable thought, he believed the only object was to get rid of or prevent odors. WALTER KUNSCH of Champaign-Urbana Sanitary District, said that this was not the only purpose--but to get rid of the whole nuisance was the real fundamental purpose of sludge digestion and H. E. Schlenz of the Pacific Flush-Tank Co., Chicago, said that to destroy solids was also a purpose of sludge digestion. Other persons pointed to the beneficial effects, such as gas production, but fundamentally, sludge digestion is a by-product process in sewage treatment for the purpose of "getting rid of a nuisance."

W. W. MATTHEWS, Supt. Gary, Indiana, explained how he found it necessary at times to add 100 lb. of lime to a one million gallon digestion tank, in order to bring up its gas production. This is one of five digestion tanks of the same size which are not loaded to capacity. As long as the tanks receive solids constantly, one or more may drop off in gas production, but if 100 lb. of lime are added to the tank, gas production will return to normal. Mr. Matthews wanted to know why. There was no answer forthcoming. Some persons do not believe in liming, others do. In some instances, small amounts of lime seem to work. By means of considerable cross-questioning from various members of the audience, it was evident that several persons were attempting to establish the fact that Mr. Matthews' tanks acted the way they did, not because of the lime, but because of some factor which he had not as yet mentioned.

When the question was raised from the floor as to whether or not one or a single, or two-stage digestion should be used, GEORGE BERNAUER of Wisconsin State Board of Health, Madison, and GEORGE MARTIN, Supt. of Sewage Treatment, Green Bay, Wisconsin, and C. C. LARSON, Chemist of the Sanitary District of Springfield, Illinois, all agreed that two-stage digestion was helpful. Generally, heating of the second stage is not essential. By use of the second stage the supernatant liquor problem is often solved, because the separation of solids from the liquid is much better.

On the matter of solids in the supernatant liquor and their effect on plant operations, DR. W. D. HATFIELD, Supt. of Sewage Treatment, Decatur, Ill., suggested that the supernatant liquor be returned to an activated sludge process because it would help eliminate bulk. T. F. Wisniewski of Madison, Wis., State Board of Health, told of returning the supernatant liquor to filters. This was confirmed by H. E. Schlenz, who said that there were evidences in several instances where this worked very well. Mr. Hook of Ft. Sheridan said that, where no heat was used in the secondary stage, the supernatant could be returned to the incoming sewage with no effect on bulking in the activated sludge process.

Participants in Operators' Breakfast Discussion

Geo. T. Schroepfer
Prof. San. Engr.
Univ. of Minn.
Minneapolis, Minn.

W. D. Hatfield
Superintendent
San. Dist.
Decatur, Ill.

H. E. Schlenz
Vice Pres.
P.F.T.
Chicago, Ill.

W. E. Sperry
Superintendent
San. Dist.
Aurora, Ill.

K. L. Mick
Superintendent
San. Dist.
Minneapolis-St. Paul

S. C. Martin
Asst. Secy.
F.S.W.A.
Champaign, Ill.

Industrial Waste

One of the interesting stories told at this session was that by WALTER SPERRY, Supt. of Sewage Treatment, Aurora, Ill., where they began with one single-stage digestion and had no supernatant liquor problems, the overflow liquor being returned to the raw sewage channels. In 1936, this was converted to a two-stage digestion system and still no supernatant liquor problems. Mr. Sperry operates his sludge digestion tank for certain periods of time and then dumps them all at once, leaving only a minimum amount of digested sludge for seed. The length of time which these tanks operate before it is necessary to dump them has varied and is dependent on the concentration of solids and the organic matter in the sludge. When a wallpaper plant was introduced into the city and the wastes were discharged to the sewage treatment plant, they thought it necessary to install some sort of waste treatment locally at the wallpaper plant. A package plant was put in to remove the casein and clay but the plant didn't work too well and the clay came on down to the sewage treatment plant. To his surprise, Mr. Sperry found that his digestors worked better. He now had from 8 to 10 per cent solids in the digested sludge and the period between dumping had been extended, so that he was obtaining longer "runs" for his sludge digesters.

In answer to a question directed to STANLEY BARKER of the New York State Health Department, in regard to the designed capacity of sludge digestion tanks, Mr. Barker referred to the work done by S. R. Rankin in developing a new approach to sludge digestion tank design, where the detention period is based on the concentration of sludge. His paper has appeared in *Sewage Works Journal*.

On the matter of what happens when sludge digestion tanks are overloaded, GEORGE E. (Doc) SYMONS, Associate Editor of *Water and Sewage Works*, and former Chief Chemist of the Buffalo Sewer Authority, recounted the experiences at Buffalo, N.Y., where the designed capacity of the tank was approximately 1 cu. ft. per capita and where the loading was approximately 0.15 lb. of solids per capita per day. Extremely high gasification rates up to 45 cu. ft.

per sq. ft. of surface aggravated scum conditions which at times were as deep as 12 to 15 ft., the solids in the scum running from 18 to 24 per cent. This scum is pumped off to be burned, but this method of handling is somewhat difficult because of insufficient pumping capacity for recirculating supernatant liquor onto the scum. Provisions are being made at Buffalo to install external heat exchangers and increase the recirculation.

When it was mentioned that in two or three sewage plants the digested sludge is discharged directly to the receiving stream, C. C. LARSON of Springfield commented on the theory that the receiving stream should carry as much of a load as it possibly can and the design and operation of the plant should be based on the ability of the stream to carry part of the load. W. H. WISELY, Executive Secretary of the Federation, warned that such ideas should not be carried too far. He and many others are of the opinion that under no circumstances should digested sludge be discharged to the receiving body of water.

W. W. MATTHEWS asked what per cent solids should be carried in a digestion tank and the answer given was "as much as you can get." The speaker giving this answer said that the actual concentration often would depend upon the type of sludge being digested.

Heated Sand Beds

One of the panel raised the question as to whether or not "radiant heat," that is, submerged heating pipes in sand beds, was effective for aiding in sand-drying. H. E. SCHLENZ of Pacific Flush-Tank Co., stated that the method had been used effectively at Durham, N. C. GEORGE MARTIN, Supt. of Sewage at Green Bay, Wis., said that the placing of the steam pipes in concrete and attempting to dry the sludge out in a concrete tank of shallow depth was no good, as there was too much water to be evaporated.

Toxic Wastes

H. T. RUDGAL, of Kenosha, Wis. raised the question as to the limit of toxic waste in sewage, mentioning the various types of industrial waste which include waste waters from metal plating, trickling liquors and wash water, oil well and refinery wastes, mine wastes, textile wastes, and wastes from engraving plants. Metals, cyanides and phenols are particularly toxic.

At LaCrosse, Wis., CARL WAHLSTROM said that they had 3.6 ppm. of copper in the raw sewage and that the

At Milwaukee Sewage Works Inspection

James L. Ferebee, Chief Engr. Milwaukee Metropolitan Sewage Works

Don E. Bloodgood, Prof. San. Engr. Purdue Univ., Lafayette, Ind.

Henry M. Heisig, Res. Chemist Milwaukee Metropolitan Sewage Works

(Prof. Bloodgood's first job in 1926 was as chemist in the then new Milwaukee plant)

copper content of the digestion tanks had reached the total of 12 to 14 thousand parts per million and the digestion was killed off. The tanks were then dumped and thereafter loaded on weekends only, when industry was not in operation. Thus, the digestion tanks were put back into operation. As to the amount of chromium present, Mr. Wahlstrom said they had found 4,000 to 5,000 ppm. in the digester but didn't know exactly how much was in the sewage. W. E. Ross, Supt. Sewage Treatment Plant of Richmond, Ind., has had experience with a large electroplating plant which operated during the war. In an effort to ascertain how to handle the waste, he investigated several other plants where plating wastes were supposedly being treated. Actually, it was found that there was no treatment in operation at any of the plants. Mr. Ross found the tests for chromium to be no good and he developed a new test. Ross decided that 0.75 ppm. was the maximum limit for chromium in the sewage and that hexavalent chromium was toxic while trivalent chromium is non-toxic. The presence of chromium in the digestive tanks slowed down the digestive action. Dr. Hatfield of Decatur, Ill., also said that the quantity of chromium allowable in sewage depended on the valence, the hexavalent being the toxic type. He mentioned that concentrations of 10 or 12 parts per million in raw sewage in shots of three to four-hour periods every week or two had not been harmful, but continuous input of chromium might well be.

Milwaukee's Sewage Plant

Following the Saturday luncheon, the Milwaukee Metropolitan Sewage Treatment Works was described briefly by JAMES L. FEREBEE, Chief Engineer. Mr. Ferebee reviewed the history of the Milwaukee plant from the time the tests were started in 1913. The plant went into operation in 1925-26 and is now up to its capacity. The design is for 165,000,000 gallons daily flow with a B.O.D. of 250 ppm. The plant produces its own power from coal and dries 55,000 tons of Milorganite a year. Milorganite being the trade name of the sewage sludge. The cost of operation of the plant is about $25,000 a week. There is no profit in the fertilizer business, but it contributes 60 per cent of the operating cost of its own production. It would cost $750,000 per year to handle the sludge, if it were not converted to fertilizer.

Following the talk by Mr. Ferebee, an inspection tour of the Milwaukee Sewage Plant was made.

OHIO RIVER CLEANUP GETS UNDERWAY

Cincinnati and Louisville Both Plan Improvements

Almost concurrently with the signing of the Ohio River contract by the various states, two of the large cities on the Ohio River announce plans to reduce stream pollution.

Cincinnati has a $25,000,000 sewage disposal system project which will include four disposal plants, the first of which on the Little Miami River will get under way in the middle of 1949. Construction of the overall project is planned for a ten-year period and all villages and towns in Hamilton county may participate by paving their share of cost of carrying off waste.

The construction of these sewage treatment works is to be paid for on a sewer rental basis. Water consumers will pay approximately 60 per cent of their water bills for the service, which payment began July 1 of this year. The City Council has approved an ordinance which appropriates the necessary funds to start construction. The sewer service tax will be collected on regular city water bills until the system is completed and all bonds issued for building are retired.

The general plan of treatment is to have primary sedimentation grip removal followed by chlorination. Sludge will be digested and the digested sludge will be chemically dewatered and incinerated.

Louisville, Ky., has approved an $8,000,000 bond issue to finance its long-range program, which at the present time consists mainly of extending sewers to suburban areas.

METHOD FOR STUDYING THE TOXICITY OF INDUSTRIAL WASTES*

by
H. HEUKELEKIAN
Associate
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NEW BRUNSWICK, N.J.

THE toxicity of industrial wastes on fish life is of primary importance and has consequently attracted the attention of many investigators, but the toxic limits of the numerous wastes and their ingredients are not completely worked out. A proper selection of the test fish, careful control of experimental conditions, and statistical analysis of the mass data are required. Hart, Douderoff and Greenback[2] made a valuable contribution to the subject of toxicity of wastes to fresh water fishes. They emphasized the importance of uniformity of procedure, conditions, test materials and methods of expressing toxicity.

Southgate[6] determined the toxicity of mixtures of poisons such as cresol and KCN, cresol and phenol, cresol and xylenol on rainbow trout and gave a method of expressing the toxicity value. A simplification of the method of evaluating the toxicity of wastes was recently reported by Anderson,[1] who determined the effect of these wastes on Daphnia. No relationship between the threshold values on Daphnia and various fish were suggested, but it is to be inferred that when a waste destroys Daphnia it may also affect the fish population, if not directly at least indirectly, by destroying their food supply.

Aside from the question as to the effect of wastes on fish life, their effect on bacteria is of importance from the standpoint of [1] natural self-purification, [2] biological processes of sewage treatment and [3] the possibility of working out a process for the separate treatment of the waste.

The phenol coefficients of industrial wastes might be used for this purpose. Phenol coefficients are determined by the use of a pure culture of the test bacteria under standardized conditions in artificial media. Disregarding the anomalies and criticisms of this method as used in evaluating disinfectants, its use in determining the toxic effect of wastes on bacteria responsible for the oxidation processes seems fraught with even greater unrealities. Biological oxidations are brought about by numerous organisms and the arbitrary selection of a given test organism would not be very revealing. A method developed for evaluating the toxicity of industrial wastes on bacteria, should approach as nearly as possible natural conditions.

The Author

Consider the B.O.D. Test

Biological oxidation is at present widely used in the dilution method of determining B.O.D. for the evaluation of the quantity of oxidizable organic matter and the amount of oxygen required to bring about the stabilization of organic matter. It has not, however, been widely used as an experimental tool for studying the effect of certain variables on the rate of oxidation, with exception of some studies on the effect of temperature, the effect of supplemental nutrients in the dilution water, and the effect of seeding on the rates obtained. It is true that the B.O.D. of industrial wastes is measured by B.O.D. determination but the objective has been to measure the quantity of oxidizable organic matter and the amount of oxygen required and not to determine the effect on the oxidation rate, or to evaluate the toxicity of the wastes.

In the course of routine determinations of B.O.D. of certain industrial wastes some anomalous results have been obtained, for example an increasing B.O.D. with increasing dilution of the waste. As a result, it has been concluded that the B.O.D. determination is valueless for wastes that manifest this phenomenon. Despite the difficulty of assigning a definite B.O.D. value to the wastes in such instances, valuable information can be obtained on the toxicity of the waste, if the phenomenon can be attributed to the effect of the higher concentration on the oxidation.

In a previous paper [3] a method was outlined for determining the toxicity of certain chemicals and wastes by comparing the oxygen utilization of diluted sewage with similar dilutions of sewage containing definite quantities of the chemicals to be tested. It is essential that the volume of sewage selected be such that maximum utilization of dissolved oxygen can be obtained in a selected time of incubation without completely depleting the oxygen. In this way a maximum margin is obtained, because as the toxic effect increases with a gradual increase in the concentration of chemicals, oxygen utilization decreases. An incubation period of 5 days was used which allows sufficient time for recovery from a possible initial retardation than a shorter period.

The range of concentrations selected depends on the potency of the toxic material. It should be wide enough to show little effect at lower concentrations and increasing effects with higher concentrations until practically all oxygen utilization is inhibited.

Dilution Method for Toxicity Determination

The dilution method for determining the toxicity of some of the constituents of coke oven effluents was used by Southgate.[6] A search of the literature would possibly reveal other similar uses. By the use of this method, it has been possible to reproduce experimentally the phenomenon of decreasing oxygen utilization by the addition of various concentrations of certain inorganic poisons such as mercuric bichloride and copper sulfate, potassium cyanide to known volumes of diluted sewage.[3] Depending upon the toxicity of the poison used oxygen utilization decreases with increasing concentration. It can, therefore, be assumed that when the phenomenon is repeated with unknown wastes it is also due to the inhibition by certain

*Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, Department of Sanitation.
Also presented before the American Chemical Society in New York City and released for publication in *Water and Sewage Works*.

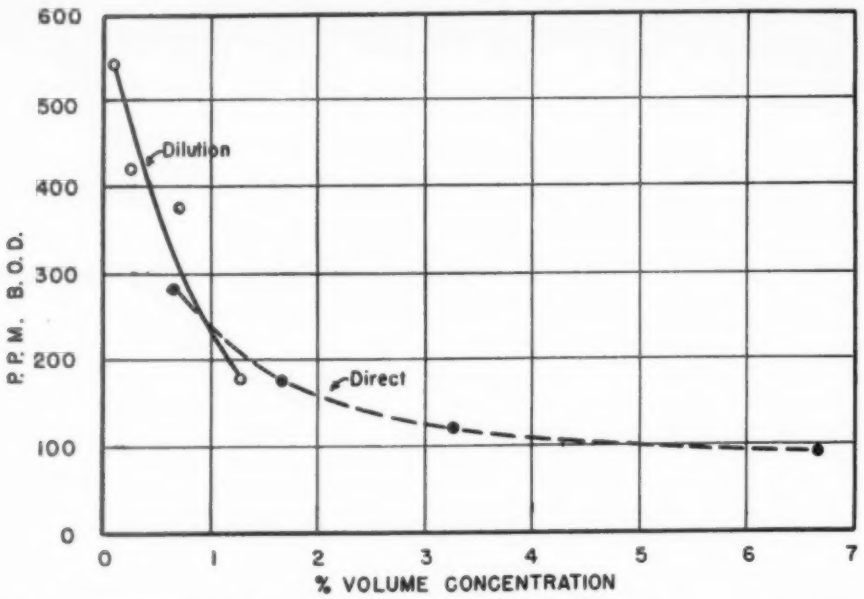

Fig. 1. Oxygen Utilization of Two Samples of Refinery Separator Effluents
(Determination by both Dilution and Direct Methods)

ingredients of the waste on the oxidation, provided that certain precautions are taken such as proper seeding and the selection of proper dilution water containing the essential minerals, in cases where these minerals are deficient in the waste.

Another condition which may have to be considered is the effect of pH value. If the waste is acid and relatively large volumes are diluted, the resultant pH may be low and may result in a lower oxidation. Normally, it is easy to neutralize such wastes before discharge. For this reason, one is not interested in determining the retarding effect of lower pH values. In addition to the inhibition due to lower pH values there may be the effect of certain toxic material which would not be revealed unless the menstruum used for oxidation has the optimum pH value.

The value of using oxidation of sewage by the dilution method as a yard stick for the toxicity of wastes is that it simulates natural conditions as closely as possible. The observed results are through the effect of toxic materials on the natural population of sewage or stream water and not on a single arbitrarily chosen organism. The substrate used is not an artificial culture of a composition and concentration completely different from that occurring under natural conditions. The environmental condition in respect to oxygen supply also corresponds to the natural environment. The toxic effect on anaerobic processes such as sludge digestion could not be as readily translated to the problem of the possible effect on self-purification and aerobic treatment processes.

Limitation to the Method

This method has certain limitations for evaluation of toxicity. In evaluating the toxicity of organic wastes or of organic chemicals added in various concentrations to the substrate, dissolved oxygen commonly disappears before toxic effects are exerted. This phenomenon stems from the fact that certain well recognized organic poisons such as phenol, and formaldehyde may (1) have an oxygen demand at a low concentration and be toxic at higher concentration, (2) be non-oxidizable and non-toxic, and (3) be non-oxidizable and toxic. Thus the effect of only an extremely narrow range of concentration can be studied by this method. Similarly, the effect of mixed wastes containing a mixture of oxidizable organic matter and organic or inorganic toxic materials may be entirely missed depending upon the concentration of oxidizable organic matter which in turn determines the degree of dilution.

Direct Volumetric B.O.D.

The range of concentration can be somewhat widened by using dilution water saturated with pure oxygen or by air saturated water which in the course of incubation is pooled and reaerated to replenish the oxygen. For the determination of toxicity of organic chemicals or of mixed wastes of unknown character, a second method was developed and reported in a subsequent paper.[6] It makes use of the direct volumetric method of oxygen determination. Since pure oxygen is used and can be replenished as the oxygen is utilized and since the vessel is shaken, there is practically no upper limit to the concentration of oxidizable material that can be employed.

There is, however, a lower limit, since the gas burette cannot be read accurately closer than 0.5 ml., which for a sample of 200 ml. would correspond to 3.5 ppm. of oxygen. With mixed wastes of unknown character the pH is adjusted, 1 per cent by volume of sewage seed; and nitrogen and phosphorus are added whenever necessary. A series is set up starting with no dilution down to a dilution to give an oxygen utilization greater than the sensitivity of the burette readings. If the oxygen utilization expressed on the basis of undiluted sample increases with increasing dilution, toxicity is indicated. With further dilution when the toxic effect is overcome constant values of oxygen utilization should be obtained. For mixed unknown wastes, it is often advisable to combine the two methods, namely, the dilution and the direct oxygen utilization methods in order to cover a greater range of dilutions than is possible with either method alone.

For evaluating the toxicity of inorganic chemicals a suitable oxidizable substrate has to be selected. Sewage, trickling filter slime, or activated sludge might serve for this purpose. Organic chemicals may be tested in a similar way or they may be used without a substrate but, instead, with small amounts of sewage, trickling filter slime or activated sludge as seed. Use of these materials either as substrate or as seed would allow forecasting of specific effects on these various sewage treatment processes. It would be possible to predetermine the degree of dilution which will not interfere with the oxidation processes.

An Example

Illustration of the comparison of the dilution and the direct method for evaluation of the toxicity of a refinery separator effluent is given in Fig. 1. The B.O.D. as obtained by the dilution method decreased with increasing concentration of the separator effluent from 540 ppm. with 0.16 percent concentration to less than 170 ppm. with 1.33 percent. The values obtained by the direct method over corresponding concentration agreed well with the dilution method and decreased gradually to 90 ppm. up to nearly 6.6 percent concentration.

By the combined use of both methods the effect of a wider range of concentrations could be studied than would have been possible by either method alone. No determinations were made with concentrations of less than 0.16 percent and, therefore, it is not possible to state whether the B.O.D. might

have been still higher if the determination of B.O.D. by the dilution method were made with less than 0.16 concentrations. The low depletions with lower concentrations than this would set up a limitation even with the dilution method.

Evaluating Toxicity

It would be desirable to attach a numerical value to the toxicity obtained by either method. A simple plotting of the oxygen utilized against the concentration would reveal whether the range is properly covered and the toxic and non-toxic concentrations. It might be advisable to express the results as that concentration which gives, say, a 50 or 90 percent oxidation. More elaborate and mathematical methods of expression might also be developed.

In conclusion it should be stated that the toxicity as evaluated by the effect on oxidation will not necessarily apply to effects on fish. Sufficient information, however, can be obtained on possible interference of the self-purifying mechanism of streams, which in turn may cast some light on the effect on fish life through their food supply. Whether this effect can be accurately predicted or not, the information obtained will be valuable for the effect not only on streams, but also on aerobic sewage treatment processes, as well as the degree of dilution necessary for industrial wastes before biological treatment can be attempted.

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New Federal Pollution Act Establishes Advisory Board

In the previous issue of *Water & Sewage Works,* we announced the passage of a Federal Water Pollution Control Act. That news item contained information setting forth most of the provisions of the Act. Recently the Federal Security Agency has released further information on the provisions of the Act.

Known as Public Law 845, the Act establishes in the Public Health Service a 10-man Water Pollution Control Advisory Board. This Board is to review the policies and program of the Public Health Service as undertaken under authority of the Act and to make recommendations to the Surgeon General. Either the Surgeon General or a sanitary engineer officer designated by him is to be chairman of this board. The members of the Board are to include one representative each of the Dept. of the Army, the Dept. of Agriculture, Dept. of the Interior, and the Federal Works Agency.

The remaining six persons are to be appointed by the President and are not to be officers or employees of the Federal Government. One of the persons appointed by the President shall be an engineer who is expert in sewage and industrial waste disposal, one shall be a person who shall have shown an active interest in the field of wildlife conservation, and, unless the President determines otherwise, one shall be a representative of municipal government, one a representative of State government, and one a representative of affected industry.

To carry out the comprehensive program of water pollution control, the work will be planned for each of the major river basins. Fourteen river basin offices will implement the program in their respective watersheds. These offices will be the operating centers and will cooperate with State and interstate agencies, with municipalities, and with industry. Technical personnel at these offices will have the support of the research and technical service facilities of the Public Health Service laboratory in Cincinnati. The new law provides for authorizations of $800,000 a year for each of the next five fiscal years to this research station for the construction of facilities for investigations and studies and for the training of control personnel.

According to the Federal Security Agency the pollution control program will be aimed at improving conditions in the most polluted streams and maintaining the clarity of the less polluted watercourses. This program does not contemplate the indiscriminate building of elaborate treatment works. All water uses of rivers, lakes, or streams, will be considered and treatment recommended will be based on these uses with due regard taken of the health, welfare, and economic considerations of the particular situation upon the national welfare.

Presiding at His First Board Meeting

(Says a certain new president of A.W.W.A. whose initials are L.H.E.—"A perfect picture, except that the table should be four times as long.")

Baltimore Plans Sewage Plant Expansion

Steel Plant to Use More Effluent

The Back River Sewage Treatment Works, Baltimore, Md., is due for an expansion. The present capacity of the trickling filters is 125 mgd., but maximum flows of 220 mgd. are experienced; therefore the plant is being expanded to 200 mgd. capacity at a cost of $646,000. Six trickling filters will cover nearly 30 acres.

J. J. Hunt, Chief of the Bureau of Sewers, has pointed out that the disposal sludge is becoming more and more of a problem and there is a need for the spending of approximately $1,000,000 for erection of a sludge drying plant. Present plans call for turning out 20,000 tons of commercial fertilizer daily.

This Back River sewage plant is the one which for many years has supplied effluent to the Bethlehem Steel Co. for its use at the Sparrows Point steel mill. The steel plant has been taking 35 mgd. and with the improvements now planned to increase the capacity of the treatment plant, the steel mill will take 60,000,000 gallons a day. Ultimately, it intends to utilize 100 mgd.

A.W.W.A. CONVENTION REPORT CONCLUDED

Plant Management & Operation and Finance & Accounting Division Sessions

WITH this installment, the report on the A.W.W.A. Atlantic City Convention (May 3-7) is concluded. The first installment in the June issue covered the general story of the convention, business meetings and such topics as Sulphur Jointing Compounds, Air Conditioning, Public Relations, and Rate Increases. The second installment, appearing in the July issue was devoted to Ground Water, Water-Shed Problems, and Water Works Schools. The report on the Purification Division Sessions also appeared in the July issue. This final installment reports the sessions devoted to Plant Management and Operation, Finance & Accounting, and Boiler Feed Waters.

B. A. Poole
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Indianapolis, Ind.

H. H. Gerstein
Ch. Filt. Chem.
Dept. of Water
Chicago, Ill.

A. E. Gorman
San. Engr.
Bethesda, Md.

M. M. Braidech
Dir. of Res.
N.B.F.U.
New York

S. F. Newkirk
Engr. & Supt.
Bd. Wat. Comm.
Elizabeth, N.J.

Plant Management and Operation Division Sessions

PLANT MANAGEMENT AND OPERATION

(Reported by H. H. Gerstein, Chief Filtration Chemist, Dept. of Public Works, Chicago.)

The afternoon session on Tuesday, May 4, 1948, of the P. M. & O. Division was presided over by Linn Enslow, Editor of *Water and Sewage Works* and newly elected president of the association.

Major Emergencies in Water Supply

A symposium on "MEETING MAJOR EMERGENCIES IN WATER SUPPLY" opened the program. In the absence of MARK D. HOLLIS, Assistant Surgeon General of the U.S. Public Health Service, the symposium discussion was opened by Sanitary Engineer Director L. M. FISHER who spoke on "THE PLACE OF THE FEDERAL AGENCIES, SUCH AS THE U.S.P.H.S. IN TIME OF NATIONAL EMERGENCY." Mr. Fisher stated that in the procedure followed by the U.S.P.H.S. in providing help in major disasters, the first step is to secure information to determine the extent and seriousness of the emergency, and the second step is to ascertain the amount of assistance required. Clearance is obtained from the state agencies and contacts made with the local authorities. The U.S.P.H.S. personnel takes temporary charge of work until the local agencies are able to take over. In widespread disasters marshal law is declared by the state authorities to provide police power necessary to carry on emergency action. A Civilian Defense Board was established in November, 1946, by the National Security Council. Basic concept in civilian defense is self help. Problems to be solved for efficient handling of civilian emergencies in waterworks are:

1. Establishment of reserve supplies of water materials.
2. Prompt repair and restoration of service.
3. Emergency evacuation of large numbers of civilians, and establishment of water supplies for refugee camps.
4. Manpower requirements for skilled and semi-skilled technicians.
5. Preparation of necessary legislation.

Viewpoint of State Authorities

B. A. POOLE, Chief Sanitary Engineer, Indiana State Health Department, presented the second discussion in the symposium on the subject of "HANDLING EMERGENCIES IN WATER SUPPLY FROM THE STANDPOINT OF STATE AUTHORITIES." Practically all emergencies can be handled on state or local level. Once in a while, like the 1937 Ohio Flood, disasters assume national proportion. Every state needs a disaster committee backed up with adequate authority. A State Water Coordinator, who is either the State Sanitary Engineer or someone in his office, should be a staff officer on the state disaster organization, and not in a subordinate position. Key waterworks men in the state should act as advisors. This type of organization would be ineffective for war emergencies where a special group with wide powers is required. Mr. Poole doubted that such laws can be enacted before an attack develops. The reserve of trained engineering personnel was drained by military duty during the last war. If such draining of key personnel were to be repeated in the next war, water departments may fall apart under the strain of bombings or other attacks. Mr. Poole was emphatic in his belief that trained waterworks personnel should be kept at home in future war emergencies. It may be necessary to pay employes higher salaries to keep them from taking more lucrative positions in industry. Mr. Poole suggested that emergencies due to catastrophes in every day operation of atomic energy plants might cause release of much "hot stuff." He felt that information should be released to State Health Departments and water supplies so that they would be prepared to cope with such disasters.

Chemical And Biological Warfare

The third discussion in the symposium, on "APPRAISAL OF RECENT ADVANCES IN CHEMICAL AND BIOLOGICAL WARFARE in RELATION TO POSSIBLE EFFECTS IN WATER RESOURCES" by H. H. Gerstein, Chief Filtration Chemist and R. E. Noble, Principal Filtration Bacteriologist, Department of Public Works, City of Chicago, was presented by Mr. Gerstein. The authors found that information regarding the subject, because of its vital importance in national defense, was closely guarded. They, therefore, confined their survey to information obtained in published articles which had been released from security regulations. Discounting apparently fantastic statements in the press regarding the extreme effectiveness of the chemical and biological warfare agents, they concluded that the potentialities of destruction and devastation of life and property by these agents are such that they cannot be ignored. In general, chemical warfare concerns itself with use in war of synthetic chemicals in forms of gases, and poisons; while biological warfare concerns itself with the use of pathogenic bacteria, fungi, viruses, protozoa, rickettscias and toxic agents derived from living organisms to kill or incapacitate human beings, domestic animals or food crops. Development of methods of mass production of crystalline botulinus toxin, a very potent food poison, is given as an example of the possibilities of warfare agents. One gram of this product represents 7 million lethal doses. Estimate is made that 1000 lbs. of botulinus toxin evenly distributed in a water supply would contaminate approximately 40 billion gallons to the extent that drinking 50 c.c. of the water would be fatal. It is logical to assume that agents chosen for attack on water supplies would be those whose toxicity and pathogenicity would not be affected by ordinary purification methods. Because of possibilities of biological agents being used for attack without warning, Messrs. Gerstein and Noble believe that the National Security Council should make available to key waterworks personnel information regarding defense measures which can be used against these agents, so that preparations can be made prior to occurrence of a national emergency. They suggest that if defense measures have not been developed, it is timely for studies in that direction to be begun immediately.

Atomic Energy Wastes

The last discussion on the symposium was given by ARTHUR E. GORMAN, Sanitary Engineer, Atomic Energy Commission. Mr. Gorman was of the opinion that "water is a basic resource which must be protected in times of war or peace." Without an adequate supply of water of good quality the war production potential of this nation would be seriously affected. The water utility industry is not in a favorable position to meet additional service demands as it was at the outbreak of the last war. There is need of much advance planning between those in charge of military production and national defense program by developing the basic data as to the industry's requirements in materials and manpower under a national emergency program. It would also be helpful if the association would present for consideration a well-integrated plan by which the industry could most effectively cooperate with public officials in such an emergency.

P.M. & O. Programmers

M. C. Smith
Ch. Engr.
Dep. Pub. Util.
Richmond, Va.

F. S. Friel
Cons. Engr.
Philadelphia,
Penna.

The rapidly growing atomic energy industry has problems in the disposal of its wastes which involve public health and safety and is conducting extensive experiments to resolve them. The atomic energy commission expects to guide the expansion of this new industry to avoid the hazards and problems which other industries have experienced because of inadequate attention to waste disposal problems. Research on waste disposals at atomic energy production plants and research laboratories now being carried on is in cooperation with professional experts in water supply, sewage disposal, industrial hygiene and environmental sanitation.

Panel In Session

The radioactive waste problem opens up a new field in research and control in which new technics, standards, and tolerances must be developed and accepted. An extensive educational and training program must be developed to train sanitary engineers, chemists, bacteriologists, waterworks operators and similar technical personnel in the fundamentals of nuclear physics and radioactivity as related to problems of public health and environmental sanitation.

In the general discussion which followed, CHAS. MOORE, Roanoke, Va., asked that the A.W.W.A. take steps to get waterworks personnel frozen in jobs in case of war. MR. JOHN LONGWELL, Berkeley, Calif., suggested the A.W.W.A. determine what waterworks should be doing in war emergency defense; and L. G. LENHARDT, Detroit, Michigan, asked that A.W.W.A. get Washington or industry to advise waterworks management as to what demands will be made of them in a war.

Fires and Fire Hazards

"NEW INDUSTRIAL FIRE HAZARDS" was presented by M. M. Braidech, Director of Research, National Bureau of Fire Underwriters. Fire losses have been increasing in the last 5 years. In 1947, the fire loss was nearly ¾ of a billion dollars; the highest in history. This staggering sum is nearly 75 per cent greater than estimated property damage in Great Britain during the first two years of the German Blitz. Present indications are that 1948 fire loss may reach a billion dollars. Annual toll due to fires, 10,000 deaths and 40,000 injured. One third of 1 per cent of fires are responsible for 60 per cent of the losses and most of these are industrial in character. Industrial expansion and new processes which involve use of equipment at temperatures ranging from a low of 300° below zero to a high of 10,000°F. and pressures from almost absolute vacuum to 50,000 lbs. per sq. in., add new fire and explosion hazards. Mr. Braidech stated that there are various new products and processes which involve increased industrial hazards. Processes develop faster than safeguards. Water is still the cheapest medium with which to combat fires. Various properties of water which make it ideal for extinguishing fires were presented. The advantages of water fog

and chemically conditioned "wet" water were discussed.

S. F. Newkirk, Engineer and Superintendent of Board of Water Commissioners, Elizabeth, N.J., spoke on "A SUPERINTENDENT'S VIEW OF FIRE PROTECTION REQUIREMENTS." Mr. Newkirk does not agree with the view that water is free to all. Those who need water should pay or contribute a fee. Fire services should be metered. Six-inch water mains should not have larger than 4 inch fire connections. Traditional design for water feeding facilities should be reviewed in view of recent war experiences abroad, where the use of water storage tanks for individual fire fighting was found advisable. Water mixed with wetting agents does a better job in fire fighting than plain water.

"WATER REQUIREMENTS FOR FIRE PROTECTION" by A. C. Hutson, Assistant Chief Engineer, National Board of Fire Underwriters, was presented by K. J. Carl, Engineer of the same organization. He stated that a general formula used in calculating required fire flows for principal mercantile districts was

$$G = 1020 \sqrt{P} (1\text{-}.01 \sqrt{P})$$

where G is gallons per minute and P is population in thousands. The formula has to be modified in many instances depending on the nature of the communities. Data were presented on fire flow requirements for residential areas and various types of industrial plants.

(The following two papers were reported by S. S. Anthony, Supt. and Engr., Water Dist., Augusta, Me.)

Marsden C. Smith, Chief Engr., Dept. of Public Util., Richmond, Va., in a paper on a "NEW AUTOMATIC PRESSURE-FLOW CONTROL SYSTEM," described a novel design of an auxiliary station entirely automatic in its operation and with a capacity of about four million gallons per day. This station was designed to supply a remote section of suburban Richmond formerly served by a Sanitary District.

The storage for this area is three miles from the station location and there is a wide fluctuation in the pressures in both the supply and discharge mains, due to varying demand on both sides of the station.

The automatic controls are designed to permit pumps to operate at maximum efficiency as measured by delivery of water, rather than by pressures, and run as long as the flow exceeds a certain predetermined value.

Additional pumps are thrown in as demand increases and are cut out as demand drops. The cycles of operation are fewer in number than in the conventionally designed station.

This system also has the desired feature of maintaining constant pressures between the station and the storage reservoirs, and since all pumps are operating at or near their designed rate, the operating efficiency remains high and costs of operation are thus reduced.

Programmers

C. H. Capen
Ch. Engr.
No. J. Wat. Comm.
Wanaque, N.J.

S. T. Powell
Cons. Engr.
Baltimore, Md.

When slides showed all pumps installed in the basement of the station a listener asked if in case of breakage of piping the station might be flooded. Mr. Smith replied that there are three 12-in. drains in the floor, so that the danger of flooding is remote.

The exterior design of the station is in keeping with other buildings in the high class residential section in which it is located, so that superficial observation would not disclose that it is other than an attractive residence with properly landscaped grounds.

Francis S. Friel, of Albright & Friel, Consulting Engrs., Philadelphia, in his paper, "DESIGNING PUMPING STATIONS FOR THE MEDIUM SIZED CITY" described and showed slides of some of the original Philadelphia pumping station buildings.

It seems that Ben Franklin bequeathed the sum of 100,000 pounds to the city of Philadelphia for a water system, but his estate yielded no such sum on settlement. It was not until 1801 that a station was built to supply raw Schuylkill River water to a wood tank in Center Square near City Hall. This low lift station had a capacity of about one million gallons per sixteen hours which was distributed through wooden mains. $150,000 in bonds were issued to pay for this installation but they sold slowly.

Atlantic City Built on an Island of Sand

This original plant was in use until 1815 when it was discontinued in favor of the Fairmount station which is still in existence. The use of water by Philadelphians has increased from one to three hundred and fifty million gallons per day. Mr. Friel then compared the size of the original steam or hydraulic pumps of the nineteenth century with the small highly efficient centrifugal pumps now in use. This small size means that smaller and simpler buildings are required to house them and safety is greatly increased by enclosed switching gear. He then described in detail and showed pictures of a newly designed station in Chester, Penna.

A 40 mile pipe line supplies the city with a capacity of 36 mgd. There are four pumps in the station, with capacities of six, eight, ten and twelve mgd. and a cone and gate valve on each pump discharge.

Mr. Friel also described the various types of pumps designed for municipal service, with suctions and discharges located at various points, side, bottom, top, end, or various combinations, as well as varying numbers of stages, either built into a single casing or a series of single stage pumps piped together and operated by a single or dual source of power, steam turbine, electric, gasoline, or diesel. Mr. Friel concluded his paper with a discussion of the advantages of various types of power with relative costs of installation and operation.

(Ed. Note: We regret that it was impossible to report the other two papers in this session. These papers were:

"Steel Water Pipe Line Appurtenances," by Laurance E. Goit, Dept. Mgr., Los Angeles Water and Power Div.; and "Steel Pipe Ring Girder Construction," by G. H. Garrett, Gen. Mgr., Thompson Pipe & Steel Co., Denver, Colo.)

FINANCE AND ACCOUNTING DIVISION

The session held by the Finance and Accounting Division was presided over by Dr. A. P. Black, Vice Pres. Elect of A.W.W.A. and Prof. of Chemistry at the Univ. of Florida, Gainesville, Fla.

Puerto Rico's Water Supply

The first paper on this session was presented by Sergio Cuevas who spoke on "PUERTO RICO'S WATER SUPPLY

DEVELOPMENTS." Mr. Cuevas' paper reviewed the history of water supply in Puerto Rico back to its earliest founding. Puerto Rico consists of 3,499 sq. miles and the population is 2,100,000 persons. Not many years ago 60 per cent of the people had no water supply and there were only 77 municipal systems, none of which operated on a 24 hour basis. Act No. 40 of the Puerto Rican legislature created the Puerto Rico Aqueduct and Sewer Service to provide good water and sewage service. It transferred all existing sewers to the new service. There were 70,000 customers, and 38,000,000 gals. daily pumped during the first year. Seventeen new sanitary systems were added that year and in the second year of operation 95,300 customers consumed 50,000,000 gals. a day. The pumpage is now up to 61.6 mgd., for a total of 98,200 consumers.

Fifty-eight per cent of the supplies are metered and they are adding 1800 more this year. Surface supplies are used for 56 cities and towns and well supplies for 24. There are 17 filter plants. In addition, there are 216 rural aqueducts for small supplies and 30 now in construction.

At the start of this program considerable leakage was found and repaired after pitometer surveys were made by the Pitometer Co. of New York. At the same time 330,000 ft. of water mains were cleaned by the National Water Main Cleaning Co. of New York.

Mr. Cuevas concluded with the statement that "Puerto Rico is on its way."

Havana's Water Supply

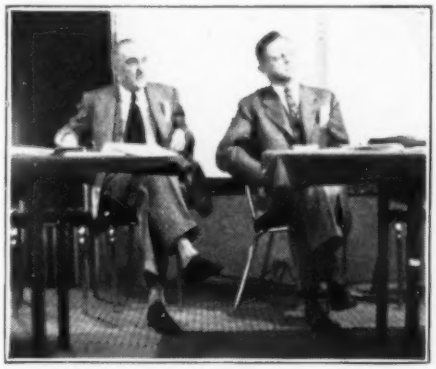
A paper on solving "HAVANA'S WATER SUPPLY PROBLEMS," prepared by Manuel Puente and Jose Garcia Montes, was read by Mr. Keller of Florida. This paper told the history of water supply in Havana from 1544 to date. For the most part the history of Havana's water supply is that it has been inadequate. The population is now 700,000 and for many years there have been many engineers and many ideas trying to solve the water supply problems of Havana.

The authors of this paper have worked out the plan which is now under way. It took from 1934 to 1946 to get it under way, and in 1946 the mayor of Havana committed suicide because he could not push through his promised improvement in the water supplies. The present mayor has started work and now the project is under way, the city being divided into four zones—a gravity zone and three pumping zones above sea level.

Mr. Montes showed slides of the various zones and described the improvements to be made.

The Water Works Dollar

Charles H. Capen, Chief Engr., North Jersey Water Supply Comm., Wanaque, N.J., read an enlightening paper on "THE WATER WORKS DOLLAR—WHENCE COMES IT?—WHERE GOES IT?" Mr. Capen sent out questionnaires on water supplies to practically all communities of over 10,000 persons and had received 492 answers. He discovered that it was easier to find out where the water dollar went than it was to find out where it came from. Where the water goes can be easily chartered as to industrial, commercial, domestic, and unaccounted for. It was found that as cities increase in size, residential areas use a smaller percentage of the total, commerical uses increase and industrial uses decrease. The amount of water supplied to outside users likewise increases.



Panel Participants
Marsden C. Smith, Richmond, Va.; Frank Amsbary, Urbana, Ill.

It is interesting to note that the sum of commercial and and industrial revenues is very nearly constant for all classes of cities, varying between 35.8 to 39.3 per cent of the total. Cities are classified in five groups depending on the population range.

Based on tabulations of the ratio of revenue to book value and ratio of funded debt to book value, Mr. Capen points out that the revenue per million gallons is less for larger cities than for smaller ones. Book value, however, appears to be fairly stable for the various size cities. Funded debt decreases materially with a decrease in the size of the city.

On the subject of where the water works dollar goes, Mr. Capen's tables and illustrations pointed out that the ratio of operating expense to gross revenue has gradually increased. Mr. Capen compared five particular cities in New Jersey with the average for the country and found that net income per million gallons produced dropped from $34 in 1913 to zero in 1938 and had returned to $25 in 1947. In terms of dollar value, however, it is around half that following World War I.

Mr. Capen also presented figures on the relation of water as fixed capital to gallons of water produced and commented on the expenditures of money for salaries and taxes as places where the water revenue is spent. One of Mr. Capen's data tables included information on persons per connection, monthly rates, miles of mains per thousand population, valves per mile of mains, etc.

As to steps for the future, Mr. Capen suggests that the most important step is consideration of the rate base. Another approach to the question is to study the water fixed capital for the several cities. If the fixed capital of any city were stepped up artificially by a revaluation of the entire plant on the basis of present day values and cost, the unit value per million gallons produced would be considerably higher than presently carried on the books. If capital value is increased, amortization should likewise be increased and this will again have an effect on the net income.

Mr. Capen believes that ordinarily the ratio of revenue to capital should not be less than ten per cent, and presented figures to substantiate this belief. As a final answer, Mr. Capen says that the solution to the problem is simple to find, difficult to accept, and most difficult to achieve. It lies in higher rates for water. To raise revenues from eight per cent of true capital value to ten per cent would require a rate increase of twenty-five per cent.

Billing and Accounting

"PUBLIC UTILITY BILLING AND ACCOUNTING" was the subject of the paper presented by A. Knaff, Supervisor, Utilities and Trans. Div., Burroughs Adding Machine Co., Detroit, Mich. Mr. Knaff reviewed the history of the company and the mechanization of accounting. He told of the first waterworks billing machine, which was a meter reading machine. Then followed posting of bills, the elimination of customer records and substitution of stub of bill. These steps followed and have been superseded by newer billing machines which now write bills, post ledgers, and supply other data quickly. Customer billing is a streamlined system now, the streamlining consisting of meter reading routes whereby meters are read uniformly, with a uniform period between reading, and read over even values, making it easy to compute. Auxiliary machines and equipment make it easier now and the develop-

ment of the past points to what is in store for the future. Mr. Knaff expects the need to continue for mechanization which will increase productivity of individuals and reduce the cost of office work. The Burroughs Company is studying in many fields to improve designs and utilize electronics to improve on the operation of present machines.

RAILROAD AND INDUSTRY WATER

(Reported by H. E. Hudson, Jr., Ch. Engr., Ill. State Water Survey, Urbana, Ill.)

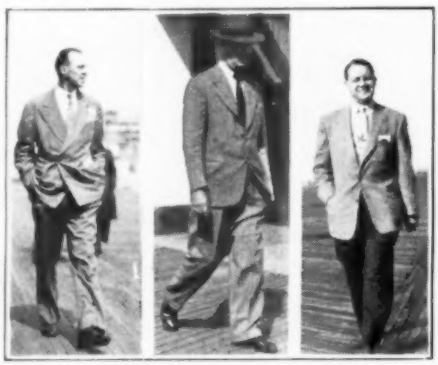
The session, May 6, sponsored by the Boiler Feed Water Research Committee made room for five technical papers. R. C. Bardwell, Chesapeake & Ohio Railroad, presided. The first paper was "TREATMENT OF MUNICIPAL WATER SUPPLIES FOR INDUSTRIAL PURPOSES," by R. B. Martin, Wallace & Tiernan Co., Inc., Newark, N.J. After a brief but comprehensive review of water quantities and qualities needed for industrial use, he moved into discussion of treatments for specific purposes. Use of the Langelier Index for corrosion control has not completely halted bacterial iron pickup. HOCl does. Iron and manganese are the major industrial bugaboos, manganese being the more difficult to handle. While softening eliminates Mn, free residual chlorination prior to filtration is also effective where softening is not needed.

Odor control is important to food industries. Some of them use breakpoint chlorination for odor destruction and to provide a disinfecting medium for the processing equipment.

In the cooling water field, slime control is a major concern. Slimes frequently cut heat transfer in exchangers far below design rates. Mr. Martin presented some graphic illustrations on the restoration of heat transfer by chlorination. Some of these contributed to water conservation by cutting water needs in half.

Sheppard T. Powell's paper on "HYDROGEN SULFIDE REMOVAL" was read by L. G. Von Lossberg, of Mr. Powell's firm, Baltimore. H_2S is gaining prominence because of increased groundwater use and because of added recognition of damage caused by H_2S, such as great chlorine absorption, corrosion of stainless steel and copper, and destruction of greensand zeolites.

Experiments in a pilot plant using forced draft aeration were described. The water containing 17.8 ppm. H_2S, was acidified and aerated. Effluent concentrations as low as 1.7 ppm. occurred. There was no advantage to acidification below pH 4.5. Removal



C. A. Knapp, New York City; Harry U. Fuller, Portland, Me.; H. T. Rudgal, Kenosha, Wisc.

was completed by use of 7.5 lb. chlorine per lb. H_2S, the oxidation being completely to H_2SO_4. Prof. A. P. Black, Gainesville, Fla., pointed out that the oxidation is enormously speeded by the presence of 0.01 ppm. Cobalt as a catalyst.

R. W. Seniff's presentation on "BOILER FOAMING AND CARRYOVER" was given by M. A. Hanson, also of the Gulf, Mobile, and Ohio Railroad. Researches sponsored by the railroads were outlined. The carryover was examined by microstudy of the liquid-vapor interface in an experimental boiler. Bursting bubbles there cause ejection of upward-moving "drops" from the liquid. This is termed "Aqua-globe injection." Relations of the rate of ejection to concentrations of solids in the boiler were indicated. Moving pictures of the ejection were shown.

The "glorified cement-mixer" as a water treatment device was described by Walter B. Leaf, Denver and Rio Grande Railroad, who spoke on "SILICA REMOVAL WITH IRON SHAVINGS." Confronted with a water bearing 85 ppm. of silica that formed a quartz-like scale in locomotive boilers, Mr. Leaf resorted to heroic methods. He developed a bed of cast iron turnings held in a regularly-rotated drum. Water accompanied by air flows through the bed, and silica is reduced to 8 ppm. This concentration, together with the high iron content, still leaves a water that "would scare you to death" but that forms a soft, easily blown-down scale.

"WATER PROBLEMS IN DIESEL LOCOMOTIVE OPERATIONS" was the topic for M. A. Hanson, GM & O. Railroad. Two main problems are cooling water for diesel engines, and makeup for steam generators. The presence of numerous metals in the engines makes them "naturals" for corrosion, a problem yet unsolved but best handled by a combination of four approaches: (1) Maintain low total solids, (2) use 1.5 lb. chromate per 100 gal. (3) close analytical control, and (4) flush out equipment whenever contaminated.

The coil-type steam generators universally used in diesel prime movers have plenty of scale and corrosion troubles. These units are extremely compact, and relatively small units can get up 275 psi. at a rate of 3000 lb. steam per hour in two minutes. The coils are acid-descaled every 10 days, and last only a year. Tank capacity is about a 3 hour supply, so a generator may receive 15 different kinds of water on one run. Distilled or demineralized waters are best for this function, but are not always available. De-aeration and maintenance of high pH, accompanied by skilled chemical control are important. L. G. Von Lossberg inquired about adverse effects of chromates on aluminum and Owen Rice, Calgon, Inc., indicated that under certain circumstances they can be halted from doing excessive damage.

Bedford, Ind., Increases Rates to Provide Expansion

The City of Bedford, Ind., is planning a $300,000 expansion program for its municipal waterworks system. This program is designed to increase the daily pumpage capacity from 2.5 to 4.0 mgd., according to Waterworks Superintendent Robert Lee.

The unique feature about these plans is that they include a request of the Public Service Commission of Ind. for a water rate study to establish a higher minimum monthly rate as a means of meeting the cost of the expansion program.—*Don Wimmer.*

Alabama Holds Third Annual Short Course

The University of Alabama, the Alabama State Department of Public Health and the Alabama Polytechnic Institute held its Third Annual Short Course and Conference for Water and Sewage Operators at Auburn, Alabama, on June 9, 10, and 11. Alex. O. Taylor, Director of Engineering Extension Service at Alabama Polytechnic Institute, acted as Director of the Short School. A meeting of the Alabama Water & Sewage Association was held during the school. Municipal officials, water works and sewage plant operators, manufacturers, engineers, professors, and department of health workers were among those who registered for the meeting.

CATHODIC PROTECTION OF STEEL WATER TANKS*

Results of an Experimental Study Plus Field Observations

by

PETER E. PALLO
Ass't Sanitary Engr.
HACKENSACK WATER CO.
HACKENSACK, N.J.

ALTHOUGH cathodic protection has become generally recognized in the water works industry as a method for protecting the submerged steel surfaces of water storage tanks against corrosion, there still exists some skepticism and confusion regarding the efficacy of this method.

A survey of existing installations shows that the water works operator has accepted two types of electrical devices for mitigating corrosion in steel tanks. One comprises the conventional cathodic protection installation, in which *direct* current from an external source—impressed on either a suspended sacrificial or a nonsacrificial anode—flows through the corroding medium (water) and becomes superimposed upon the wall of the tank, where it stifles the flow of current accompanying the electrochemical corrosion process. The other type, also referred to as cathodic protection, requires no suspended anodes. In their stead, a system of electrical resistances is attached to the outside wall of the water storage tank, and *direct* current applied from an external source flows through the resistances into the wall of the tank. In its progress report of 1946, the New England Water Works Assn. Committee on Cathodic Protection of Steel Tanks and Standpipes observes that this so-called electrodeless installation is one about which "the Committee has as yet been able to find little information and less electrical theory to substantiate the claims of the manufacturer."

Numerous conflicting reports of the protection secured with the electrodeless circuit, the confused impression that cathodic protection employing sacrificial anodes increases the dissolved oxygen content of the stored water; and the recent introduction of the galvanic magnesium anode as a method of corrosion prevention instigated the experimental studies presented in this paper.

*This paper, presented before the Am. Water Wks. Ass'n., is here published by permission of the Association.

The Author

Scope and Method

The investigation was designed to determine the degree of protection obtained in bare steel tanks provided with (1) an aluminum anode with an applied external potential, (2) a galvanic magnesium anode without applied potential, and (3) the electrodeless circuit with an applied external potential. A fourth tank, used as a control, was afforded no protection.

In order to ascertain the effect of cathodic protection on the dissolved oxygen content in the stored water, a stoneware crock was employed as a blank or control.

The study was conducted as rigidly and practically as possible. The interior walls of the experimental steel tanks were sandblasted clean, thereby increasing the surface activity of the exposed metal. By draining and filling the experimental units daily, the bare steel walls were subjected to the action of influent waters high in dissolved oxygen content. Corrosive activity was further enhanced during the 24-hour detention period by the increase in temperature of the stored water to room temperature.

Corrosion was measured in terms of actual weight loss of metal as well as by its recognized outward manifestations.

The experimental apparatus was installed at the purification plant of the Hackensack Water Co. at New Milford, N.J. The water used for the investigation was furnished from this purified, moderately aggressive surface supply, and was taken as it came,

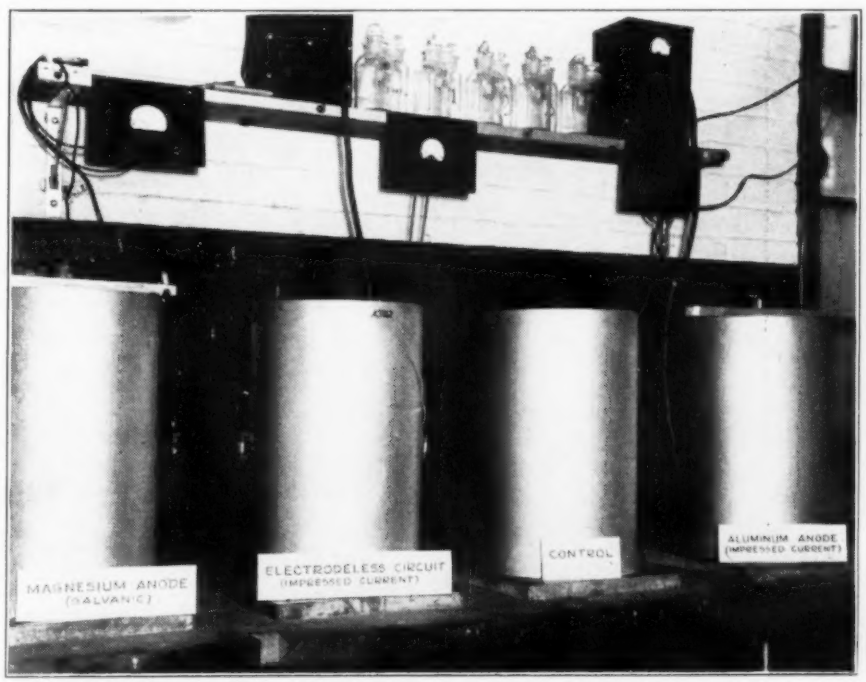


Fig. 1—Experimental Cathodic Protection Tanks.

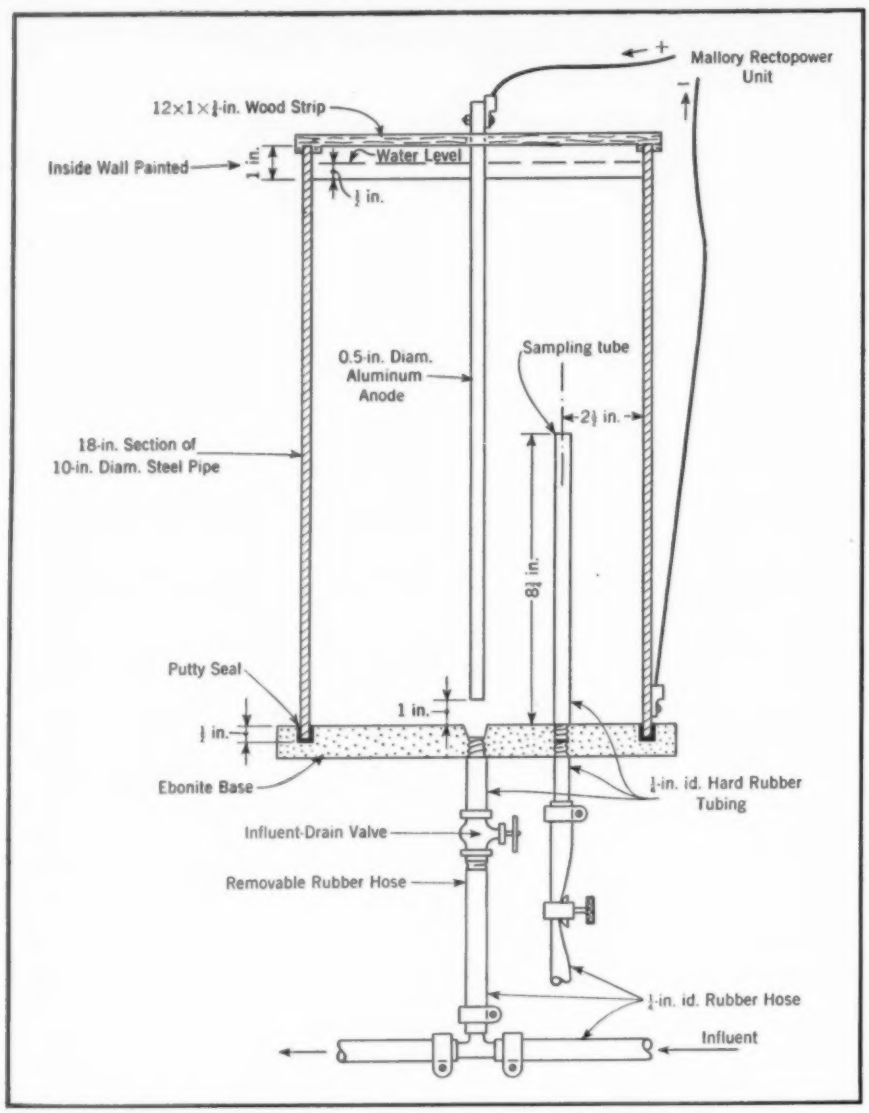


Fig. 2—Section Through Experimental Tank No. 4.

with all seasonal variations in temperature, dissolved oxygen and both chemical and mineral content. An average analysis of the experimental tank influent water for the duration of the investigation is shown in Table 1. This water had an average specific resistance, at 20°C., of 4,340 ohms per cubic centimeter.

Installation

Four 18-in. lengths of 10-in. diameter steel pipe were cut from a single length of pipe purchased in the open market. These lengths were sand-blasted clean both inside and out, then painted on the outside with two coats of aluminum for protection against atmospheric corrosion. After being carefully weighed to the nearest ounce, the tanks were set in an ebonite base and sealed in with Dupont PX putty. A stoneware crock, 20 in. deep and 10½ in. in diameter, completed the tank installation. Each of the five units was provided with a common drain and influent connection, as well as a

Table 1
INFLUENT WATER ANALYSIS

Item	Quantity ppm.
pH	7.3
Color	8
Turbidity	0
Free CO_2	5
Alkalinity* ($CaCO_3$)	51
Soap hardness ($CaCO_3$)	79
Total iron	0.03
Total solids	150
Magnesium	5.5
Calcium	27.9
Sulfates	36.0
Chlorides	10.3
Silica	6.3
Dissolved oxygen	11.2

*Methyl orange.

sampling tube which extended half way up into the tank at a distance of half the radius from the tank wall. All connections other than the influent-drain valve were of nonmetallic material, hard rubber tubing and rubber hose being used. The installation details of one of the steel experimental tanks (No. 4) is shown in Fig. 2.

Protection Applied

Tank No. 1 was equipped with a Dow Chemical Co. magnesium anode, 18 in. long and 0.840 in. in diameter. The anode, supported by a wooden strip attached across the top of the tank, was centered along the axis of the tank and terminated 1 in. above the bottom of the ebonite base. The anode and tank wall were electrically connected through a double-throw switch to facilitate milliammeter readings and to exclude ammeter resistance from the circuit.

The current density at the start of the investigation was calculated to be 4.2 ma. (milli-amps) per square foot

Table 2
IRON PICKUP IN EFFLUENT

Tank No.	Type of Protection	Iron Pickup—ppm.		
		Maximum	Minimum	Average
1	Magnesium anode (galvanic)	5.97	0	0.46
2	Electrodeless circuit	14.87	3.65	8.14
3	Control	13.27	3.60	7.10
4	Aluminum anode (impressed current)	0.11	0	0.02

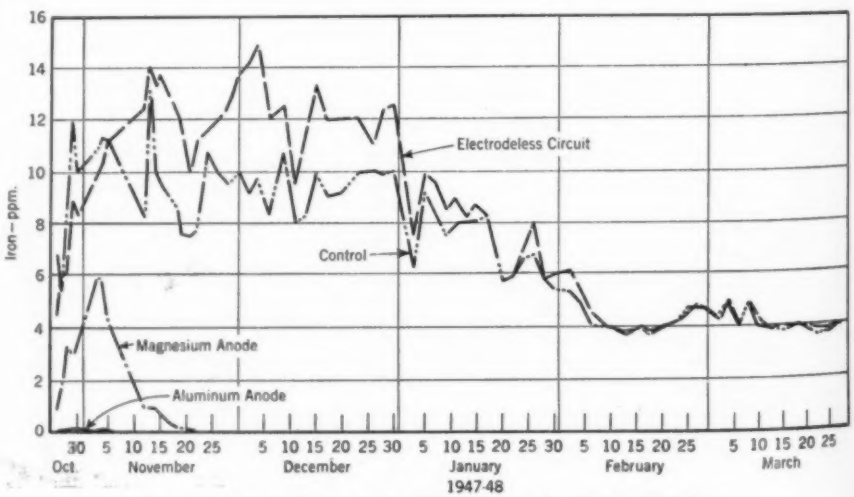


Fig. 3—Iron Pickup by Water in the Four Tanks.

Fig. 4—Interior Tank No. 1.

or 1 amp. per 240 square feet of metal surface. With the progressive development of a protective wall coating, the current flow was found to decrease progressively and proportionately. At the termination of the experiment, the current density was found to be only 0.7 ma. per square foot, or 1 amp. per 1,480 square feet.

Tank No. 2 was furnished with the wall element electrodeless circuit type of installation. A Mallory Rectopower unit delivered 30 ma. at 8 v. to two sets of two 1,000-ohm wire-wound resistors in parallel, which were connected opposite to each other on the exterior tank wall, midway down the side of the tank. The two negative or return lines to the rectifier were connected to the exterior tank wall at a 90-deg. angle to the resistor connections, one at the top and the other at the bottom of the tank. The current applied to the tank shell was calculated to be 8.1 ma. per square foot or 1 amp. per 125 square feet of metal surface.

Tank No. 3, employed as the control, was afforded no protection and was allowed to corrode freely.

Tank No. 4 was supplied with an Alcoa 17ST4 aluminum anode, 18 in. long and 0.50 in. in diameter, supported, centered and terminated from the ebonite base as in the magnesium anode installation (see Fig. 2). The current was obtained from a Mallory Rectopower unit, delivering 20 ma. at 8 v. The positive lead of the rectifier was securely fastened to the aluminum anode, and the return or negative lead was made fast at the bottom of the exterior tank wall. The current density applied to the tank shell was calculated to be 5.4 ma. per square foot or 1 amp. per 185 square feet of metal surface.

Fig. 6—Interior Tank No. 3.

Procedure

The tanks were operated on a daily fill-and-draw cycle during the 5½ months of the investigation. Milliammeter and voltmeter readings were taken before draining and after refilling. Samples of the influent and effluent waters of the four tanks were collected for analysis on an average of three times weekly. The determinations made on each of the five samples collected included temperature, pH, turbidity, color, alkalinity, dissolved oxygen and total iron pickup. For the stoneware crock, the temperature and dissolved oxygen content of both the influent and effluent waters were the only determinations made. These were recorded as check determinations.

Table 3
Loss in Weight of Metal

Tank No.	Type of Protection	Weight Loss Oz.	Weight Loss Per Cent
1	Mg anode	5	0.67
2	Electrodeless	17	2.27
3	Control	15	1.99
4	Al anode	3	0.40

After every draining operation, the bottom of each tank was flushed free of settled deposits before refilling, care being exercised not to disturb any coating or deposit on the tank walls.

Upon completion of the experimental studies, the steel tanks were removed from the system and were cleaned and weighed to the nearest ounce to determine the total loss of iron.

Results

In presenting the results of the experimental work, it must be pointed out that, because of the selected location of the sampling tubes, the analyses of the tank effluent samples represent an average condition existing in the tank at the time of sampling.

Iron Pickup

Determinations of the amount of iron pickup (Fig. 3), indicating the rate of active corrosion, show that the maximum iron concentrations were found in the effluents of the so-called electrodeless circuit and the control tanks, the former surprisingly exhibiting generally higher iron values although it was supposed to be a protected unit. It is apparent that both tanks 2 & 3 conformed to the behavior that may be expected of freely corroding surfaces.

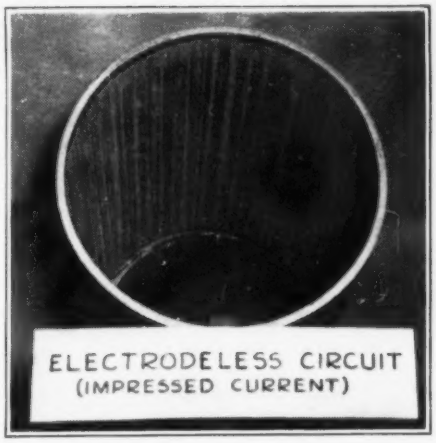


Fig. 5—Interior Tank No. 2.

The high iron concentrations observed in the effluent of the tank protected by the galvanic magnesium electrode implied that an aggressive corrosion attack occurred during the first four weeks of the investigation. Following this period adequate protection was demonstrated.

The effluent of the tank provided with the aluminum anode (impressed current) showed a slight iron pickup during the first week of service and only incidental minor increases thereafter. These results also indicate effective corrosion prevention.

The maximum, minimum and average iron pickup values for the duration of the investigation are given in Table 2.

Loss in Weight of Metal

The loss in weight of metal from the four tanks was found to conform to the order in which the higher iron concentrations were observed in the effluents of the experimental tanks; that is, the greater the iron concentration in the effluent, the greater the loss in weight of metal. These losses are shown in Table 3.

Fig. 7—Interior Tank No. 4.

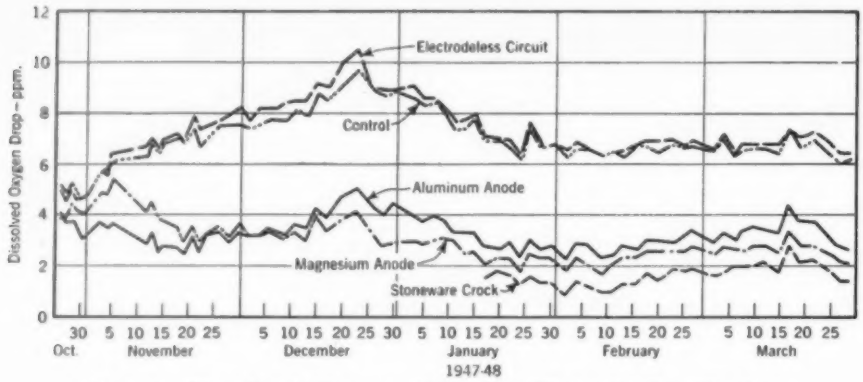


Fig. 8—Dissolved Oxygen Drop by Water in the Tanks.

Surface Conditions

The corrosion product adhering to the walls of both the electrodeless circuit tank and the control was found to be a granular, loosely adherent iron oxide which is low in resistance to the diffusion of oxygen.[2] The corrosion assumed a distinct vertical pattern attributed to the method of manufacture of the pipe. The only difference observed on the walls of the two tanks was a *marked pitted appearance* in the *electrodeless circuit tank* which was *not* evident in the control. This pitting was not characteristic of the customary cavity found under tubercles, but rather gave the impression that a bursting action had occurred at numerous points in the oxide coating.

Figures 5 and 6 show the condition of the tank walls prior to the final cleaning operation. The corrosion products were easily removed from both tanks and, as was to be expected, the cleaned surfaces exhibited a conspicuously grooved appearance.

In passing, it is of interest to mention that the bursting action previously described was also noted on the walls of a 125,000-gal. elevated wash water storage tank. This structure, located at the New Milford Plant of the Hackensack Water Co., was equipped with the electrodeless circuit (in the form of the Rusta Restor Element Anode).

The current density being applied was 1 amp. per 3,000 square feet. A report made on the tank interior referred to the "pock-marked appearance of the red-lead covering, suggestive of perforated paint blisters."[3] Thirty-one months of observation and field experimentation within the 125,000 gal. tank led to the conclusion that the "Element Anode" system had afforded *no protection* against corrosion.

The wall of the experimental tank protected with the galvanic magnesium anode (Fig. 4) was covered with a fine, buff-colored, tightly adherent deposit. A qualitative spectrographic analysis of a sample of this coating showed that it contained magnesium, calcium, sodium, aluminum, silica, iron and slight traces of copper and manganese. Vertical rust streaks which had formed during the first month, during which active corrosion occurred, were found to be effectively sealed and no appreciable attack was noticed on the wall of the tank after cleaning. The investigation also showed that the magnesium anode exerted a chemical conditioning effect on the stored water to render it less aggressive, as evidenced by a substantial increase in the pH and alkalinity of the tank effluent. These results with cold water conform to those reported in actual practice when the galvanic magnesium anode is used to control the corrosion of hot water storage tanks.[4] Although the galvanic magnesium anode has inherent limitations, it has been demonstrated that it can be successfully used for inhibiting corrosion. Field experimental applications have been installed in the risers of elevated water storage tanks[5] and in deep well turbine pumps[6].

The tank protected with the aluminum anode and impressed current displayed a slight tendency to corrode during the first week of the investigation. Within the third week a recognizable whitish gray film had begun to form on the tank wall. The points of initial corrosion attack became coated with increasingly heavier white deposits as the investigation proceeded. This is clearly shown in Fig. 7. Sudrabin[7] explains the formation of the heavy white deposits as resulting from the application of a current in excess of the minimum protective current density required.

A qualitative spectrographic analysis of a sample of the wall coating showed it to contain calcium, magnesium, sodium, aluminum, silica, iron and a trace of manganese. After the removal of the coating, the tank wall presented the appearance of well-preserved, clean gray steel.

Oxygen Depletion

Greater dissolved oxygen depletion values (Fig. 8) were found in the effluents of tanks Nos. 2 and 3, which were shown to be corroding freely. Maximum, minimum and average dissolved oxygen depletion values are shown in Table 4.

Table 4

DISSOLVED OXYGEN DEPLETION

Tank No.	Type of Protection	Dissolved Oxygen Drop—PPM.		
		Maximum	Minimum	Average
1	Mg anode	5.4	1.7	3.0
2	Electrodeless	10.5	4.5	7.2
3	Control	9.7	4.6	7.0
4	Al anode	5.0	2.3	3.2

The natural loss of dissolved oxygen observed in the effluent of the stoneware crock (Fig. 8) was less than that found in the effluents of the cathodically protected tanks. These results emphasize the fact that the

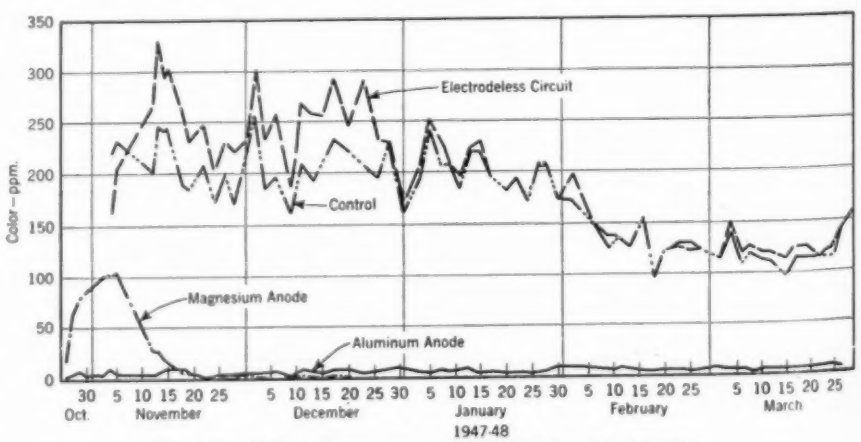


Fig. 9—Color Increase of Water in the Tanks.

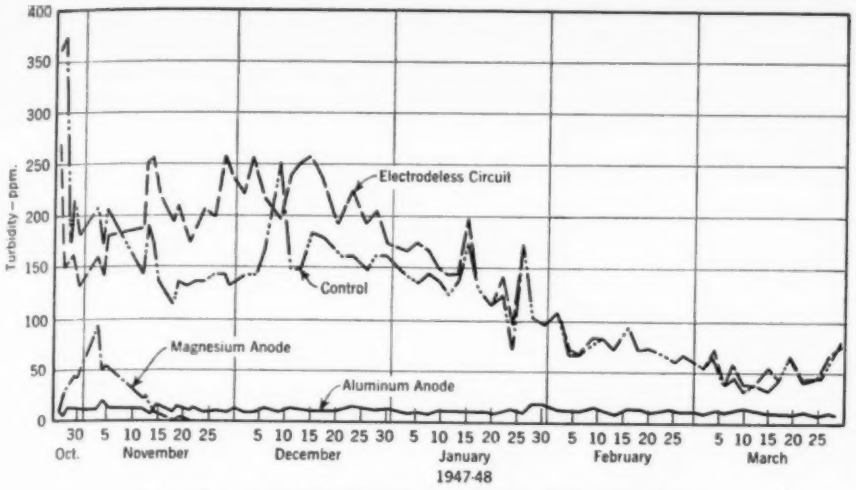


Fig. 10—Turbidity Rise of Water in the Tanks.

dissolved oxygen content of the water is not increased when sacrificial anodes of the galvanic type such as magnesium or aluminum with an applied external potential are used. It proved important to note that the dissolved oxygen saturation values were higher for the stoneware crock than for the steel tanks. Were it not for this fact, erroneous deductions about increased dissolved oxygen concentrations could easily have been made.

Color and Turbidity Increase

The water works operator readily understands and appreciates only too well the outward manifestations of corrosion, such as the increase in color and turbidity (*see* Fig. 9 and 10). The increase noted in the color and turbidity of the effluent from the tank protected with the aluminum anode (impressed current) was of small magnitude compared to the freely corroding tanks and is attributed to the coagulating effect caused by the dissolution of the aluminum anode.[8]

Conclusions

The results secured during this investigation demonstrate cathodic protection to be a practical method of protecting the submerged steel surfaces of water storage tanks.

1. The use of a properly installed sacrificial aluminum anode provided with an external potential was found to prevent adequately the corrosion of a bare steel surface.

2. The use of a properly installed sacrificial galvanic magnesium anode was found to inhibit the corrosion of a bare steel surface despite an initial aggressive attack.

3. The electrodeless or "Element Anode" circuit, mistakenly referred to as cathodic protection, showed *no* protection against corrosion. This conclusion is in agreement with that reached after 31 months of an actual field investigation and observation.

4. The dissolved oxygen concentrations in the stored water were not found to increase when sacrificial anodes, either of the galvanic type, such as magnesium, or aluminum with an applied external potential, were used.

Acknowledgments

The author gratefully acknowledges the constructive interest professed by the management of the Hackensack Water Co., Weehawken, N.J., which provided the equipment, space and water for the investigation, as well as the facilities of its analytical laboratory.

The author is indebted to Rolf Eliassen, Prof. of San. Eng., New York University, New York City; F. J. LeFebvre, Electro Rust-Proofing Corp., Belleville, N.J.; P. S. Wilson, Gregg Co., Philadelphia; H. A. Robinson, Dow Chemical Co., Midland, Mich.; and R. C. Bromelmeier, Aluminum Co. of America, Edgewater, N.J., who so generously contributed their time and suggestions.

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(Also see "Cathodic Protection" by L. P. Sudrabin, pp. R109-121, *Water & Sewage Works*, Ref. & Data Issue—April 1948.)

U.S. PUBLIC HEALTH SERVICE CELEBRATES SESQUICENTENNIAL ANNIVERSARY

The United States Public Health Service celebrated its 150th anniversary this summer. Actually the Public Health Service did not come into being until 1912, but in 1798 the Marine Hospital Service was founded as a function of the U.S. Treasury Dept. It was initiated for the simple purpose of providing care for sailors of the Merchant Marine who were taken sick on shipboard and had to be provided with medical care in seaports where they had no legal residence.

Not until 80 years later did the service actually become in fact a "public health service" when it was made responsible for seaport quarantine. In 1887 the bacteriological laboratory was established in New York and in 1891 was moved to Washington. This was the beginning of the Hygienic Laboratory.

In 1902 after more than a hundred years, the organization's name was changed to the "Public Health and Marine Hospital Service," and in 1912 it became simply the U.S. Public Health Service".

The Hygienic Laboratory was converted into the National Institute of Health in 1937. As a part of the Public Health Service there is a sanitary engineering division which for 34 years recently was under the direction of J. K. Hoskins, who rose to the rank of Admiral and Assistant Surgeon General. This division is now under the head of Mark D. Hollis.

During the late war, many members of this Sanitary Engineering Division served throughout the country and overseas. One of the principal units of the division in its studies of sanitary engineering problems is the Water and Stream Sanitation Investigation Station, at Cincinnati, Ohio, long under the direction of Col. Streeter recently retired, now under the direction of V. D. McKenzie.

FLORIDA'S 16th ANNUAL SHORT COURSE ON WATER SUPPLY AND SEWERAGE*

Fla. Sew. Wks. Assn. Holds Concurrent Meeting

FLORIDA'S Short Course for Water and Sewage Plant Operators held on the University of Florida campus, June 7-11, enrolled 143 persons from 63 towns, 11 states, and from two foreign countries, Colombia and Guatemala. During the session the Florida Sewage Works Assn. held its 6th annual meeting. Thirty-three members of the Association were present.

Operators were given a forty-hour course of instruction divided equally between lectures on fundamentals and work in University laboratories under supervision. The course was divided into three sections. Dr. A. P. Black, Professor of Chemistry at the University and Vice-President of the American Water Works Association, headed the faculty for the advanced water treatment section. The sewage treatment section met at the University's modern sewage treatment plant with the faculty composed of Professors John E. Kiker, Wilson Calaway and George Grantham, together with David B. Lee, J. G. Patterson, John Wakefield, and Ralph Metcalf of the Florida State Board of Health; Ben F. Borden of Smith and Gillespie, Inc., Jacksonville; Walter Parks of Reynolds, Smith and Hills, Jacksonville; N. S. Chamberlin of Wallace and Tiernan Co., Jacksonville; and W. F. Ebsary, Chemist of the Tampa Water Works. The Elementary Water Treatment Section was handled by S. W. Wells and Howard Nelson of the State Board of Health, Charles Black and Roger Schneck of Black Laboratories, Inc., Gainesville.

Special sessions were handled by Frank McDonald of the Electro-Rust Proofing Corp., Walter N. Dashiell of the U. S. Public Health Service, Robert McDaniel of the Naval Air Station, Jacksonville, Robert McNary of the Florida Citrus Commission, C. F. Wertz of the Department of Water and Sewers, Miami, and E. G. Wheelhouse of Yeomans Brothers Co. in Tampa.

For the first time during these annual short courses a special session was developed for swimming pool operators. These operators enrolled in Water Treatment Sections for the first four days with the fifth day devoted to demonstration and other work at the University of Florida Swimming pool. Ralph Baker of the Florida State Board of Health was in charge of this part of the program.

A certificate was presented to the Bradenton Water Treatment Plant by Dr. W. T. Sowder, State Health Officer, for exceptional plant operation during the last six months. The certificate was accepted by Thomas Paul, Chemist and Chief Operator of the Bradenton plant. Runner-up was the St. Augustine Water Treatment Plant. Honorable mention was also given to the following:

Town of Perry Water Treatment Plant

City of Panama City Water and Sewage Treatment Plant in the St. Andrews Area

West Palm Beach Water Co. Water Treatment Plant

G. Manual Turner, Assistant Dean of the Extension Division, acted as coordinator for the short course.

Certificate for Exceptional Plant Operation

David B. Lee, State San. Engr.; Thomas Paul, Supt., Bradenton Water Tr. Plant. Wilson T. Sowder, M.D., State Health Officer

*From notes supplied by Perry M. Teeple, Sec'y, Fla. Sew. Wks. Assn., and pictures from Dave Lee, Ch. Engr., Fla. Dept. of Health.

Advanced Water Section, 16th Florida Short Course

Sewage Section, 16th Florida Short Course

Florida Sewage Works Association

The sixth annual meeting of the Florida Sewage Works Assn. carried on the business of the association as well as participating in the Fla. Short School and Conference.

Officers elected for the ensuing year were:

President

J. Robert Hoy, Dist. Mgr.
Wallace & Tiernan, Jacksonville, Fla.

Vice President

S. Keith Keller, Gen. Supt.
Pinellas Co. Water System,
Clearwater

Secretary

Perry M. Teeple, Reg. San. Engr.
Fla. Dept. Health, Jacksonville

Following the annual dinner, George S. Russell, President of the Federation of Sewage Works Associations, discussed the qualifications on which the Kenneth Allen Award is made. Ralph F. Brennan, Chairman of the Florida Section Committee for the Kenneth Allen Award, announced the recipient of the Kenneth Allen Award for 1948 to be David B. Lee, Director, Bureau of Sanitary Engineering, Florida State Board of Health. Mr. Lee responded briefly and appropriately.

The technical sessions included the following. A conducted tour with Associate Professor John E. Kiker, Jr., in charge of the tour, through the recently completed University sewage treatment plant, a versatile installation of 0.75 mgd. capable of affording several methods of standard treatment with a flexible arrangement for diversions of flow through the plant.

N. S. Chamberlin, Sanitary Chemist for Wallace and Tiernan Co., Inc., presented the latest viewpoints on chlorination of sewage. This followed discussions by John G. Patterson and Ralph L. Metcalf of the Florida State Board of Health on Vocabulary of Sewage Treatment and on Primary Sewage Treatment Processes, respectively; and instruction by Instructor Wilson T. Calaway and Prof. Kiker in Secondary Sewage Treatment Processes and in Arithmetic of Sewage Treatment, respectively.

Discussion of Sewage Plant Maintenance and of Safety Methods was given by R. W. McDaniel, Supt. Sewage Treatment Plants, Naval Air Station, Jacksonville; David B. Lee, Director, Bureau of Sanitary Engineering, Florida State Board of Health, presented the State Regulations concerning Sewerage and Sewage Treatment; Mr. Patterson and J. W. Wakefield, Bureau Sanitary Engineers, discussed the Status of Treatment in Florida and Principles of Stream Sanitation, respectively.

B. F. Borden, Florida's FSWA Director, and W. J. Parks, of Reynolds, Smith and Hills, consultant firm that designed the University's treatment plant, discussed Sewerage Design, Construction and Records. Industrial waste treatment, particularly dealing with citrus fruits, was discussed by R. R. McNary, Research Fellow, Florida Citrus Commission; E. G. Wheelhouse, Yeomans Brothers Co., and Asst. Prof. George R. Grantham. The latter also described Metering Devices and Methods in connection with Sewage. R. M. Hoyt, Solvay Sales Corp., described the handling of chlorine cylinders and related safety procedures.

Elementary Water Section, 16th Florida Short Course

THE IMPORTANCE OF THE PROFESSIONAL STANDING OF THE WATER WORKS MANAGER*

by

L. A. JACKSON
Engineer-Manager
LITTLE ROCK MUNICIPAL WATER WORKS
LITTLE ROCK, ARK.

IN discussing such an important topic as the professional standing of the Water Works Manager, my first thought in the treatment of this subject raises some very logical questions:

What about this industry that we are engaged in?

Does the waterworks business qualify for dignity and professional standing?

Are we proud of our chosen profession, and can we demand the respect for our principal calling in the same degree that other industries and professions have been able to obtain?

Let us analyze our business in retrospect, and determine if we can qualify on the basis of age, size, importance, and any other factors generally considered as necessary in creating business prestige.

Age usually engenders respect, and although our chosen profession is not as old as the so-called learned professions of religion, law and medicine, our age record is certainly better than some of the allied industries that have gained recognition and importance in the public mind. To give just one example: It has not been so very long ago that Benjamin Franklin flew his kite and since discovered electricity. The all-important electrical industry has developed in the short span of 200 years.

Compare this brief history with that of our own business that dates back many more years. On the subject of water supply history, records reveal that water was distributed to residents of Pompeii even before the Christian Era. This fact has been reported in a paper by Samuel McElroy that was published in the *Journal of the Franklin Institute* in February of 1865. I think it of interest to quote a short portion of this article, not so much for its historical significance as for the fact that it reveals that the director of the public water supply in those early days was a man of considerable importance. The quotation describes the manner in which Pompeii was supplied,

The Author

"The letting out of the public water to private persons was a source of revenue, the supervision of which was entrusted to an officer of high rank, and many precautions were taken to prevent fraud in this matter. The aqueducts were each charged with a certain number of supply pipes, and no new pipe could be inserted without a special application to the Emperor. Permission being obtained, the applicant was assigned a calix, as it was called, of the assigned dimensions. This was simply a brass measure fixed in the castellum or reservoir, the diameter of which regulated the quantity of water which could pass through it, and for which the applicant was charged. Beyond the calix the pipe was private property; but, more effectually to prevent fraud, it was enacted that for a distance of fifty feet the calix and the pipe should be of the same diameter. The right to a supply of water was strictly personal (not attached to houses) and the supply was cut off at every change of house ownership. The right, previously granted, was sold by the superintendents to the highest bidder. Those inhabitants whose means of interest were insufficient to obtain a private supply pipe were obliged to carry their supply from the public fountain."

Although such methods used to take care of water consumers by these early purveyors are not recommended to improve your professional standing in your communities, the "calix" appears to be the earliest form of metering device for the equitable distribution of water supply.

The Age and Size of Our Industry

The improvements made in distribution, water treatment and service through the intervening years are too well known to elaborate here, but certainly our age, experience and steady progress should qualify us for professional standing in the community.

Now suppose we analyze our industry and determine how we measure up on the basis of size. The size of an enterprise or industry is usually an impressive factor in moulding public opinion. As age demands respect, size on the other hand denotes power, strength and importance. In fact, these terms are synonymous with "big business".

Factors generally used to measure the size of an industry may include such related items as number of plants, number of people employed, number of customers together with the annual production and capital investment statistics. Figures relating to the magnitude of the water works industry released by the Am. Water Works Association reveal some very interesting statistics worthy of mention at this point.

In 1940 there were 10,656 incorporated communities in the United States that were served by public water supply systems. In addition to these there were some 2,200 other public supplies in operation serving unincorporated communities and water districts. It is conservatively estimated that these water supply systems combined now serve more than 85 million people, and this total number of people served is increasing at the rate of one-half million a year. These figures would indicate that the water supply industry has a total of approximately 20 million consumer accounts.

The total investment in water supply facilities in the United States will aggregate more than 5 million dollars and a conservative forecast indicates that this investment will be increased at the rate of 200 million dollars per year in the ten-year period we are now entering.

The number of people employed in the waterworks systems throughout the continental United States is approximately 85,000, or one employee per 1,000 water consumers served. Equivalent figures on some of the other so-called "big businesses" are not available to report, but it is safe to say that the statistics expressed

*An article based on the context of a speech made by the author before a Texas Water & Sewage Works Short School at Texas A&M College.

above make a very respectable showing for the waterworks industry.

Engineers have estimated that the total output of water will reach 12.5 billion tons per year, and if we take the tonnage output of some of our major industries the comparison resolves itself into these astonishing figures:

STEEL—Annual output is only equal to a 3-day water output.

OIL—Annual output is only equal to an 8-day water output.

AGRICULTURE—Annual output is only equal to an 8½-day water output.

COAL—Annual output is only equal to a 24-day water output.

In other words, the tonnage of water produced in any one year is approximately nine times the production of steel, oil, agriculture and coal combined. In view of the above facts, I think you will agree that we can certainly qualify our industry for distinction if we use size factors as a measuring stick.

Before leaving the subject of size, however, I would like to point out another interesting fact. Reference was made above to the total investment in the waterworks industry on a national level. It quite often happens and it may be true in your case that the investment in water supply facilities in your city is greater than any other capital investment by a local industry.

Another interesting point in this connection is the fact that the ratio of investment in water utility systems to the number of employees engaged therein shows a decided contrast to the corresponding ratio in other industries and trades.

Invested Values

As a result of studies made by Louis R. Howson, Engineer, and reported in a recent paper, the investment in waterworks plants per employee engaged therein is approximately $70,000, compared to a $6,000 figure in the manufacturing industry, and a $7,000 capital investment per employee in the wholesale and retail trades.

A recent survey made in a small southern city reveals that, on the average a $7,000 investment is necessary per single job with figures for gas and electric industries running $25,000 and $40,000 investment per job respectively.

May I point out the fact here that although we operate expensive systems and have the care and responsibility for capital investment ten times greater than other major industries, our payrolls are not commensurate to our responsibilities due to the prevailing low wage levels in the waterworks industry as compared with all other productive enterprises. On this subject I would like to quote from an editorial by Mr. William W. Brush in the January, 1946, issue of *Water Works Engineering* the following:

"Waterworks employees at all levels are notoriously underpaid compared with corresponding scales, work and responsibilities in many other industries."

"Correction of this condition is necessary if the better waterworks employees are to be retained and desirable new personnel seecured."

You Know—but, Does Your Community?

I do not believe it is necessary to emphasize the factor of business importance of water supply to this group. You and I know that water supply service is more vitally necessary in the growth and welfare of a community than any of the other industries. Further, there is no point in bragging among ourselves on the importance and achievements of our own industry, but it is important that we keep telling our community and the country at large about it.

The people in your community should know some of these facts:

They should know the relation of the water supply industry to public health and how through scientific treatment unsafe water has been made safe for drinking purposes; a fact responsible for reducing the typhoid fever death rate in American cities from 200 to less than one death per 100 thousand persons.

It would be desirable if they knew the part that our industry has played in improving the standard of living. People have always had water to be sure, but do they know that 100 million faucets have taken the place of hand pumps, buckets and pails.

On the question of fire protection do they know that distribution systems formerly delivered insignificant amounts of water to cisterns at low pressures, but that these systems today are now designed to make available to hydrants on the street corners quantities of water ranging from 1,000 gallons per minute for small communities to 12,000 gallons per minute for the larger cities, thereby saving billions of dollars in fire losses each year, to say nothing of the savings in insurance premiums.

They should know the importance of water supply to industrial development.

All through this discussion we have been trying to justify an equally favorable public opinion to the business of water-supply as that enjoyed by other industries. The answer is simple and should close any argument as to which service or contribution is more important to your community. Unless an adequate and safe supply of water of suitable quality is available, you just don't have any industrial development.

In short, the industry that we are engaged in is building better homes, better health and better communities.

Up to this point we have been discussing the qualifications of our industry, and in view of its fine performance record it seems reasonable that we, as representatives and workers in the industry, are entitled to "a place in the sun" and the stamp of "professional standing" on our job.

Several years ago I heard the late Mr. W. N. Gladson, Dean of Engineering at the University of Arkansas, define our job in a manner that has always impressed me. It seems that the services of Dean Gladson had been enlisted by popular demand to manage the local water properties until a successor could be secured. He was then in his 70's and operated the property only for a short period, and in describing his duties he said that he was surprised to learn that the operator of a water utility was called upon to give expert advice on so many diversified and technical subjects. He recalled that it had been necessary for him to qualify in such subjects as hydrology; limnology; chemistry; bacteriology; microscopy; and others relating to sanitary, mechanical and civil engineering. Apparently during his short period of directorship he was obliged to handle customer complaints, for he added that besides requiring expert skill and knowledge in the various technical subjects, he also had developed into a very good diplomat and public relations counselor.

Know Your Job

Dean Gladson had the respect of his community; he had professional standing. Why? Because he was qualified; he knew his job.

"Know Your Job"—That in my opinion should come first above everything else in gaining the confidence and respect of your community, and in placing your job upon a higher professional level.

One of the greatest barriers in putting our jobs on a professional basis is the large number of non-professional men, politicians or political appointees, who are running waterworks plants throughout the country. I do not mean to convey the idea that waterworks managers and operators must have college degrees, or must have expert knowledge on all of the technical subjects we have to deal with, but I do say that the director of a water supply should by experi-

ence and study be able to speak intelligently on all subjects relating to his business. The ones I refer to have no interest in the industry or profession, and are not particularly anxious to improve their knowledge in waterworks practice. This type of operator is not only hurting our job prestige but is causing an enormous turnover in waterworks personnel, which is not good for the profession.

Public opinion is usually formed from some mental association and I can think of nothing worse than the reaction that develops when incompetent men, who do not know their business, try to deal with the public.

Selling Ourselves to the Public

I think it is generally conceded that the operation of a modern waterworks system calls for experience, skill, and educational background, and I do not believe anybody in the waterworks fraternity would question our right to professional standing, but the real problem is—How shall it be attained?

That is where you and I enter the picture, for it is largely a job of selling ourselves to the public, a job of public relations, if you please to call it such.

The American Water Works Assn. has recognized this as our No. 1 problem and is doing something about it in its recently launched Public Relations Program, involving the supplying of guides in public relations undertakings for water works managers and superintendents at a considerable expenditure of Association funds. Many of you have been receiving these systematic releases of the series of "Public Relations Studies" and "Public Relations at Work," and have probably already profited from these valuable guides.

To be successful, it is generally conceded that any publicity program designed to improve the profession should originate with and be conducted by ourselves *at the local level.* The national association can help and guide us by furnishing the carefully prepared data for our use, and subsequently, if funds permit, these local programs can be augmented and supported by publicity work at the national level.

The A.W.W.A. Deserves Support

This brings me to one of my pet subjects, and I knew from the very beginning I would eventually work around to it; that is, the importance of supporting our national association in its undertakings in the interest of water works men the country over, that they may receive just recognition.

A recent survey made by our national association reveals that of 1904 cities with population of 5,000 and over, only 777 or 41% were in A.W.W.A.'s membership columns. The Association, with 64 years of experience behind it, has been of immeasurable value to the industry in the past and with expanded support can meet any of the problems which the future may bring.

What is needed in advancing our profession are more enthusiastic water works men who are better equipped to serve their communities, and a strong and unified group, all working to improve the status of the waterworks profession and your job.

N.E.W.W.A. PROGRAM FOR ANNUAL MEETING

N. Y. Section A.W.W.A. to Participate

The New England Water Works Assn. has completed the program for its annual meeting to be held in New York City at the Hotel Pennsylvania on Sept. 14-17 inclusive.

The New York Section of A.W.W.A. will hold no meeting of its own this Fall but has accepted the invitation of the N.E.W.W.A. to take part in its meeting.

The technical program of the meeting is as follows:

MONDAY, SEPTEMBER 13

Evening

Executive Committee Meeting

TUESDAY, SEPTEMBER 14

Forenoon

Opening of Annual Convention.

Afternoon

"Recent Labor Legislation and its Effect on Public Utility Operation" by John H. Murdoch, Jr.

"Prestressed Concrete Pipe" by R. M. Doull

Evening

Past Presidents' Dinner

President's Reception and Dance

WEDNESDAY, SEPTEMBER 15

Forenoon

"Water Works Insurance Problems" by Charles C. Goodrich

"Watershed Inspections in Connecticut, Including Problems of Housing Developments" by Frederick O. A. Almquist

"Modern Diesel Practice for Water Works Plants" by David Gallagher

THURSDAY, SEPTEMBER 16

Forenoon

"An Inverted Siphon for the Assabet River Crossing of the Wachusett Aqueduct" by Stanley M. Dore

"Discussion" by Paul F. Howard

"Solving a Difficult Clarification Problem at Kennebunk, Maine" by Messrs. F. Smith and M. Lane

Afternoon

"Seismic Reconnaissance for Ground Water Development" by Scott Keith and Rev. Daniel J. Linehan, S.J.

"Introduction of Prechlorination of Slow Sand Filters" by Dr. Samuel Jacobsen

"Water, Water Everywhere" sound movie in color.

Evening

Club Room

Manufacturers' Dinner

Award of the Dexter Brackett Memorial Medal to William Storrie, Consultant Engineer, Gore & Storrie, Toronto, Ontario, Canada.

Award of the Twenty-five Year Service Certificates.

FRIDAY, SEPTEMBER 17

Forenoon

Superintendents' Round Table.

"Water Works Propaganda" by Fred J. Reny

"Modern Equipment in Water Works" by Roger W. Esty

Entertainment during the meeting will include a golf tournament, a three hour boat trip around Manhattan Island, and dancing after the banquet. Special entertainment for the ladies includes a sight-seeing bus trip and a radio broadcast party.

The N. Y. Section A.W.W.A. will hold a luncheon on Thursday, Sept. 16th.

Finch Appointed To Indiana Stream Control Board

Succeeds the Late C. K. Calvert

Lewis S. Finch, Chief. Engr. of the Indianapolis Water Co., was apointed as a member of the Indiana Stream Pollution Control Board to fill the vacancy left by the recent death of C. K. Calvert. Anson Thomas, member of the board, was elected as vice-president to succeed Mr. Calvert. Prof. R. B. Wiley, head of the Dept. of Civil Engineering of Purdue University, Lafayette, is chairman of the board.—*Don Wimmer.*

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The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

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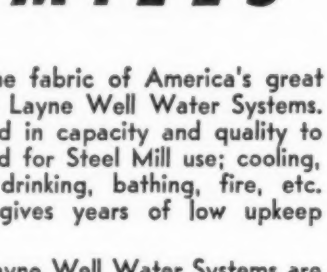

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MEETINGS SCHEDULED

SEPT. 1-2—WINNIPEG, CAN. (Royal Alexandria Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

SEPT. 14-15—DES MOINES, IOWA (Hotel Kirkwood)
Iowa Sewage Works Association. Sec'y-Treas., Leo Holtkamp, P. O. Box 310, Webster City, Iowa.

SEPT. 14-17—NEW YORK, N. Y. (Hotel Pennsylvania)
New England Water Works Association. Sec'y, Joseph C. Knox, 609 Statler Bldg., Boston, Mass.

SEPT. 14-17—NEW YORK, N. Y. (Hotel Pennsylvania)
New York Section A.W.W.A. Sec'y, R. W. Blanchard, 50 West 50th St., New York, N. Y.

SEPT. 16-17—CHEYENNE, WYO. (Hotel Plains)
Rocky Mountain Section A.W.W.A. Sec'y, O. J. Ripple, 710 Colorado Bldg., Denver 2, Colo.

SEPT. 21-22—LAFAYETTE, IND. (Memorial Union Bldg. Purdue Univ.)
Fourth Industrial Waste Utilization Conference. Chairman, Prof. Don E. Bloodgood, School of C. E., Purdue Univ., Lafayette, Ind.

SEPT. 22-24—FLINT, MICH. (Hotel Durant)
Michigan Section A.W.W.A. Sec'y, Raymond J. Faust, State Dept. of Health, Lansing, Mich.

SEPT. 22-24—ATLANTA, GA. (Ga., Institute of Technology)
Georgia Water & Sewage Association and **Georgia Water & Sewage Works School** (17th Annual Meeting). Sec'y, Van P. Enloe, R. F. D. 7, Box 372, Atlanta, Ga.

SEPT. 23-24—MINOT, NO. DAK. (Clarence Parker Hotel)
North Dakota Water & Sewage Works Conference. (20th Annual Convention.) Sec'y-Treas., Jerome H. Svore, State Health Dept., Bismarck, N. Dak.

SEPT. 29-30—CLARKSBURG, W.VA. (Stonewall Jackson Hotel)
West Virginia Section A.W.W.A. Sec'y, John B. Harrington, State Dept. of Health, Charleston, W. Va.

SEPT. 30-OCT. 2—CLARKSBURG, W.VA. (Stonewall Jackson Hotel)
West Virginia Sewage & Industrial Wastes Association. (Annual Meeting) Sec'y, R. G. McCall, Room 643, Capitol Bldg., Charleston, W. Va.

SEPT. 30-OCT. 1—SIOUX FALLS, SO. DAK. (Carpenter Hotel)
South Dakota Water & Sewage Works Conference. Sec'y, W. W. Towne, State Board of Health, Pierre, So. Dakota.

OCT. 5-6—FORT DODGE, IOWA (Hotel Wahkonsa)
Iowa Section A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

OCT. 7-8—MANSFIELD, OHIO (Mansfield-Leland Hotel)
Ohio Section A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 3, Ohio.

OCT. 10-13—GALVESTON, TEXAS (Buccaneer Hotel)
Southwest Section A.W.WA. Sec'y-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 13—FRYEBURG, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Water District, Winthrop, Me.

OCT. 13-15—ATLANTIC CITY, N.J. (Haddon Hall)
Pennsylvania Water Works Association (52nd Annual Meeting). Sec'y, E. R. Hannum, P. O. Box 315, Windber, Pa.

OCT. 13-15—BOSTON, MASS. (Statler Hotel)
American Society of Civil Engineers. (Fall Meeting.) Asst. Sec'y, Allen Wagner, 33 West 39th Street, New York 18, N. Y.

OCT. 13-15—MONTGOMERY, ALA. (Whitley Hotel)
Alabama-Mississippi Section A.W.W.A. Secy'y, John L. Snow, First National Bank Bldg., Montgomery, Ala.

MEETINGS SCHEDULED

OCT. 15-17—PHOENIX, ARIZ. (Hotel Westward Ho)
Arizona Water & Sewage Works Association and **Arizona Section A.W.W.A.** Sec'y, Helen Rotthaus, Sanitary Engineering Div., State Capitol, Phoenix, Ariz.

OCT. 17-20—BOSTON, MASS. (Copley Plaza Hotel)
Public Works Congress. Executive Director, Donald F. Herrick, American Public Works Association, 1313 East 60th St., Chicago 37, Ill.

OCT. 18-20—PITTSBURGH, PA. (Hotel Wm. Penn)
Engineers' Society of Western Pennsylvania. (Ninth Annual Water Conference) Chairman, H. M. Olson, 171 Longue Vue Drive, Mt. Lebanon, Pa.

OCT. 18-21—DETROIT, MICH. (Hotel Statler)
Federation of Sewage Works Associations. Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
Michigan Sewage Works Association. Sec'y-Treas., R. J. Smith, 545 Elizabeth St., E. Lansing, Mich.

OCT. 20-22—PHILADELPHIA, PA. (Hotel Penn Sheraton)
4-States Section A.W.W.A. Sec'y, W. A. Welch, 748 Public Ledger Bldg., Philadelphia 6, Pa.
(Joint Meeting)
Western Penna. Section A.W.W.A. Sec'y, L. S. Morgan, State Department of Health, Greensburg, Pa.

OCT. 24-26—JEFFERSON CITY, MO. (Hotel Governor)
Missouri Section A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

OCT. 25-26—RICHMOND, VA. (Hotel John Marshall)
Virginia Section A.W.W.A. Sec'y, W. H. Shewbridge, 708 State Office Bldg., Richmond 19, Va.

OCT. 25-29—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania State College Water Works Operators School. Director, R. E. Stiemke, Dept. of Civil Engineering, State College, Pa.

OCT. 26-27—SPRINGFIELD, ILL. (Leland Hotel)
Illinois Water Works Operators' Association. Sec'y, C. E. Corrington, Clinton, Ill.

OCT. 27-29—RIVERSIDE, CALIF. (Mission Inn)
California Section A.W.W.A. Sec'y, H. C. Medbery, Water Department, 425 Mason St., San Francisco, Calif.

OCT. 28-29—LA CROSSE, WIS. (Hotel Stoddard)
Wisconsin Section, A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison, Wis.

NOV. 1-3—OTTAWA, CAN. (Chateau Laurier)
Canadian Institute on Sewage & Sanitation. Sec'y, A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

NOV. 4-6—ATLANTIC CITY, N.J. (Madison Hotel)
New Jersey Section, A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N. J.

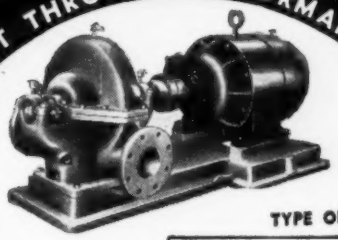
NOV. 8-10—ASHEVILLE, N.C. (Hotel George Vanderbilt)
North Carolina Section A.W.W.A. Sec'y, G. S. Moore, Supt. Water & Light, Albemarle, N. C.
and
North Carolina Sewage Works Association. Sec'y-Treas., G. S. Moore, P. O. Box 125, Albemarle, N. C.

NOV. 8-12—BOSTON, MASS. (Sessions-Mechanic Bldg.)
American Public Health Association. Sec'y, Dr. Reginald M. Atwater, 1790 Broadway, New York 9, N. Y.

NOV. 18-20—PANAMA CITY, FLA. (Hotel Dixie Sherman)
Florida Section A.W.W.A. Sec'y, S. K. Keller, Box 151, Clearwater, Fla.

DEC. 8—WATERVILLE, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Water District, Winthrop, Me.

Another Great PUMP "by Aurora"
WINS RESPECT THROUGH PERFORMANCE
DOUBLE SUCTION



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AURORA CENTRIFUGALS
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SIDE SUCTION
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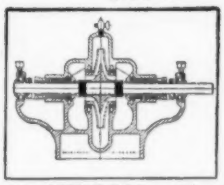
AURORA HORIZONTALLY SPLIT CASE DOUBLE SUCTION SINGLE STAGE CENTRIFUGAL PUMPS



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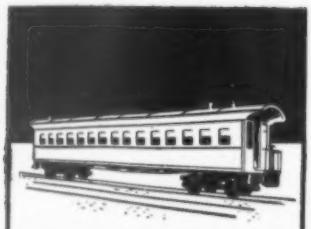
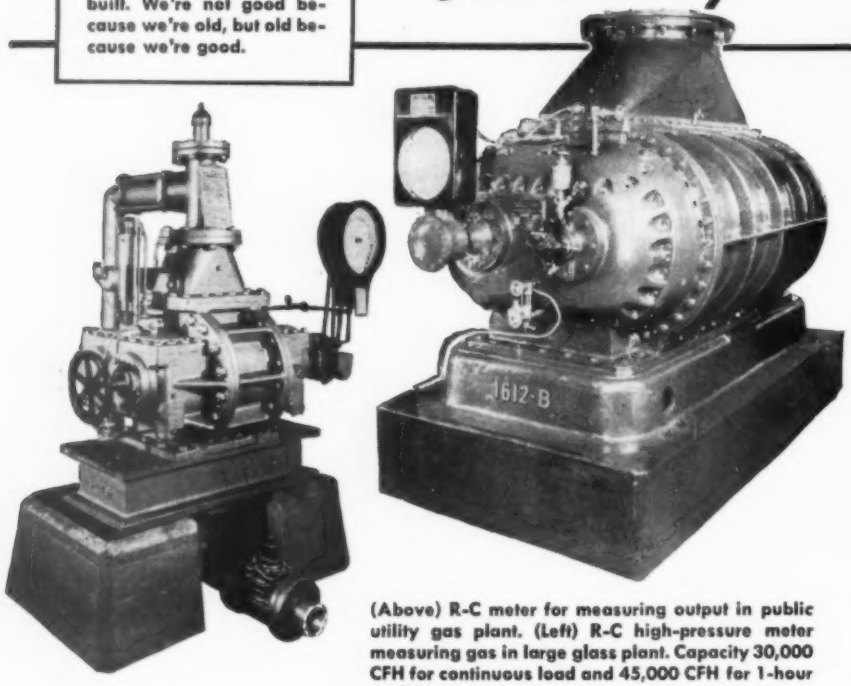


George M. Pullman's first sleeping car went into service in 1859, five years after the first Roots Blower was built. We're not good because we're old, but old because we're good.

Measure

INPUT OR OUTPUT WITH "CASH REGISTER" *Accuracy*



(Above) R-C meter for measuring output in public utility gas plant. (Left) R-C high-pressure meter measuring gas in large glass plant. Capacity 30,000 CFH for continuous load and 45,000 CFH for 1-hour peak load.

Wherever gas needs to be measured . . . for buying, selling or processing . . . you get unfailing accuracy from R-C Positive Displacement Meters. The reasons are:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture or impurities.
2. Accuracy does not depend on uncontrollable factors.
3. Accuracy is not subject to adjustment of meter or recorder by operators.
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5. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast-iron surfaces.

The wide use of R-C Meters by public utilities, producers, industrial users and processors is the best evidence of satisfactory performance. For details, ask for Bulletin 40-B-14 or write us about your specific problem.

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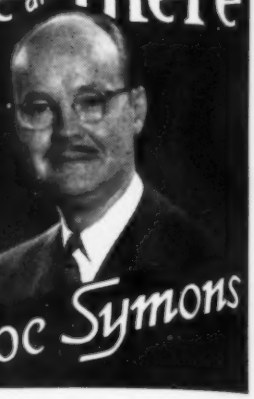
Here and There with Doc Symons



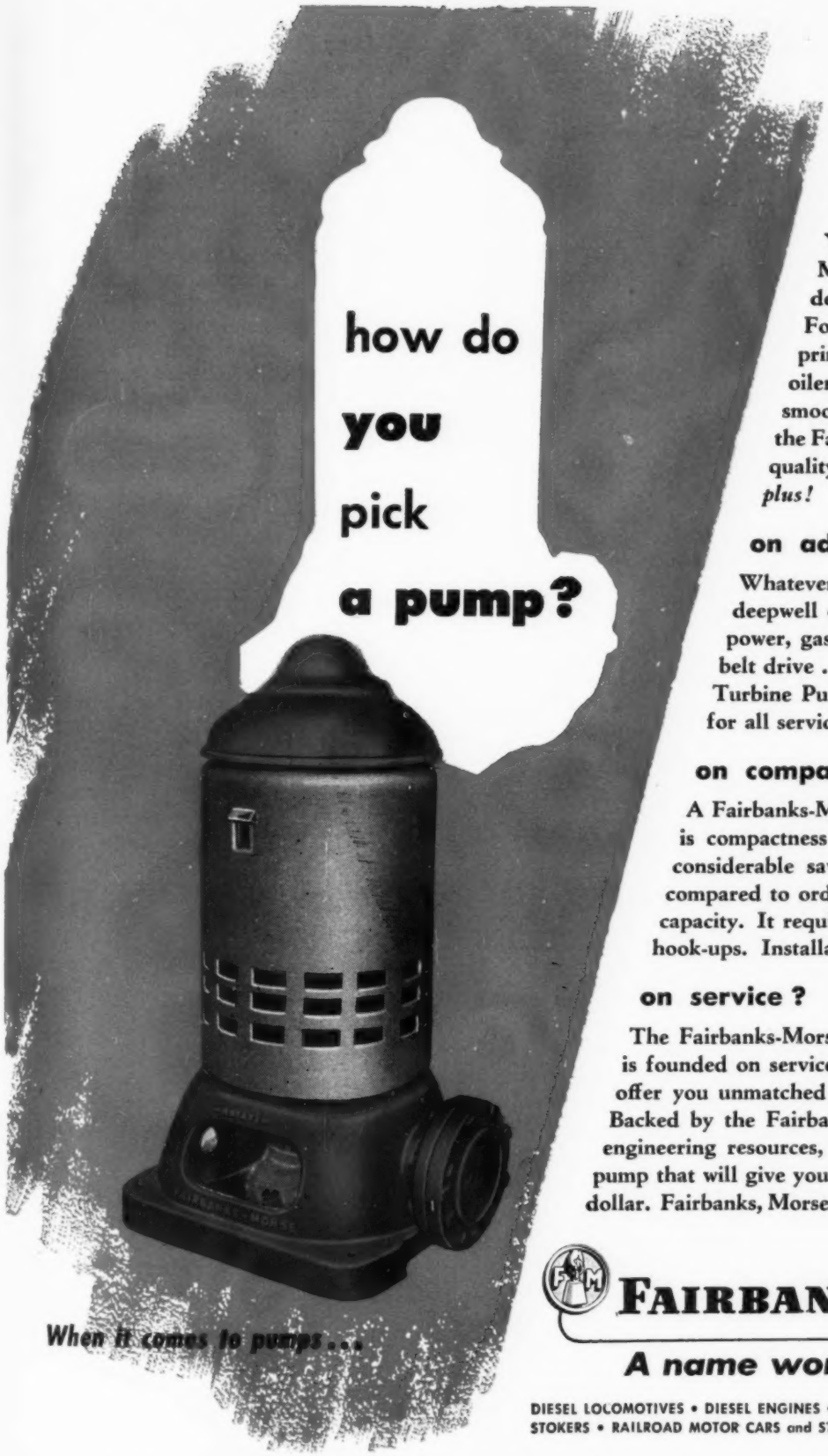
H.T.M.A.—And now to continue the story of the A.W.W.A. Convention in Atlantic City.—Remember? In the June issue, I left off with the theme song of the convention, "Now Is The Hour" as played and sung at the Family Night Party. We ("Gin," Jimmy, and I) had arrived for that session on time and had good seats down front. We sat between Joe Hume Gardner (Pres., Bingham and Taylor Corp., Arlington, Va.), whom we had known in Buffalo, and "Gene" Dugger, Past Pres. A.W.W.A. and Gen. Mgr. of the Newport News Water Works Comm. Gene ducked out early for a little sleep, but Mrs. Dugger was there applauding right up to the end.

* * *

We didn't do much room hopping this year, because "Gin" (that's my girl) developed an ulcer last winter and late hours and liquid refreshment (except milk) were still taboo for her. From reports of light sleepers, though, I understand that conviviality was the order of the evening in a number of places throughout the three hotels. And in place of afternoon tea, I'm told, several of the feminine registrants found the famous Brightom Punch to be thoroughly enjoyable.

* * *

The Society of Council Bluffers was in attendance, except for Mary Van Atta, to whom we all sent best wishes for a speedy recovery. In addition to the regular members of that exclusive society (the Wendell La Due's, the "Casey" Jones', the Dan Saunders', the Jake Van Atta's, Attmore E. Griffin, Harry Boehner, Sam Newkirk, and V.T.Y.) there were two associate members present: Mrs. Harry Boehner, and Mrs. "Doc" Symons. We didn't have a meeting of the society this year, but next year in Chicago I plan to schedule a breakfast session. How about 2 a.m. some morning, Bluffers?



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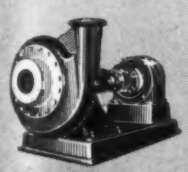
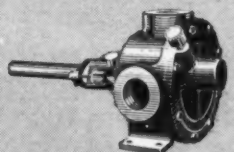
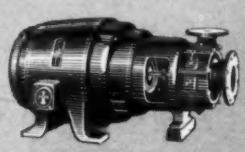
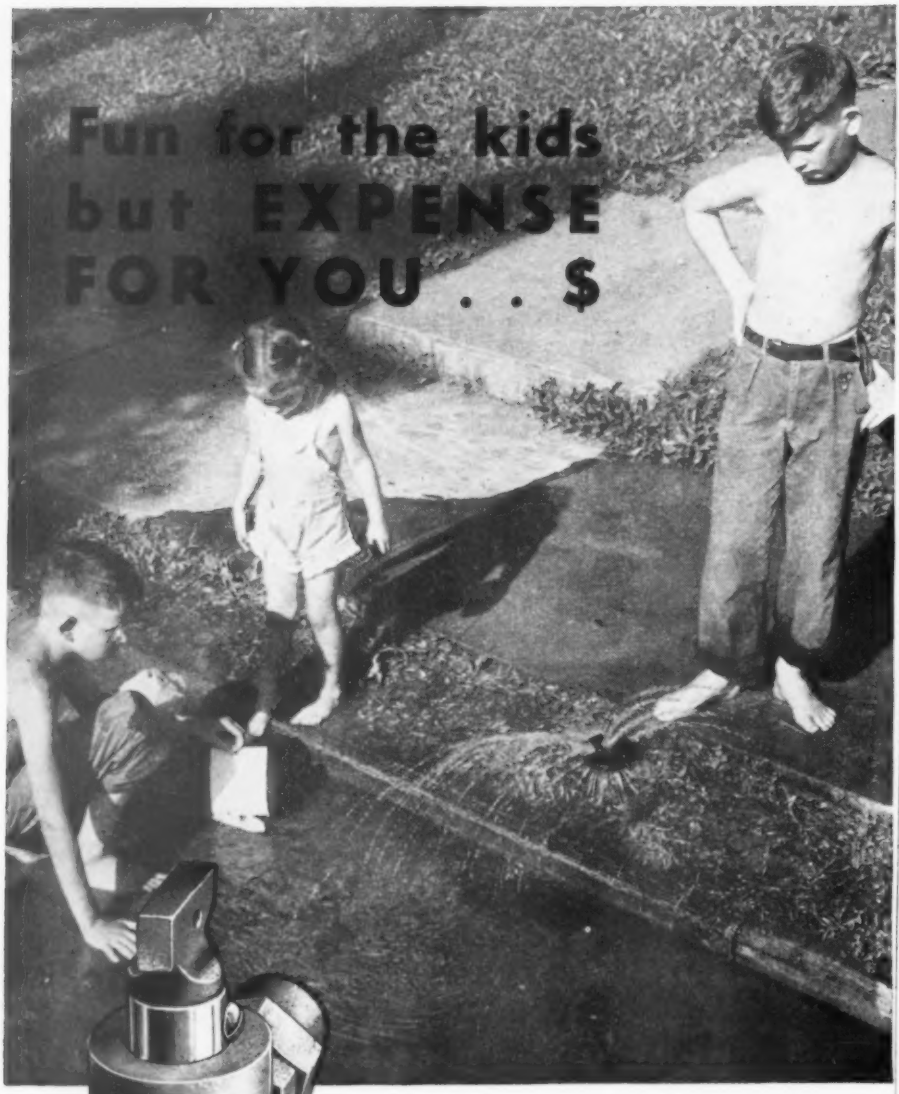

Trash Pump

Side-Suction


Rotary


Builtogether



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Springs caused by curb stop or connection failures may make fun for the kids, but they certainly add to your maintenance costs. An easy way to reduce maintenance expenses over the years to come, is to start now to specify and install Glauber ground-key connections. They are designed, made and inspected to assure you easy shut off and on operation and to eliminate leaks or maintenance troubles during the life expectancy of the original installation. Write today for catalog and prices on your current requirements.

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Little Things I'll Remember for a Long Time.—The tremendous ovation given Charlie (Columbus, Ohio) Hoover, when he was presented with Honorary Membership—Ted (Columbia, Penna., Mgr.) Kain's four-in-hand tie knots—Bernal Swab's movies, particularly of the mountain goats (how'd they get in there?)—The dirty floor at the Hotel Chelsea for the annual dance (and by dirt, I mean the crumbs, and spillings from the annual banquet—not swept up)—the noisy movie projector in one of the sessions—Ralph (Public Relations) Cooney and his story about the taxi driver, who didn't learn a g.d. thing yesterday—Ed (Chicago Bridge and Iron) Alt and his dialect stories (also his beautiful wife Zita, who listens to them just as though she had never heard them before)—Vic (St. Louis County Water) Weir and his limerick—The autographed bottles of bourbon presented to the outgoing and incoming A.W.W.A. prexys and Linn Enslow's statement that he would save his to toast his grandson's 21st birthday, two decades hence—The waiter who spilled a whole glass of water on Mrs. Guy (Bondo) Northrop sitting next to Jim (Nat. Water Main Cleaning) Brown—The very, very pretty girls; young, younger, and youngest—The elevator in convention hall which was hung with drapes and provided with arm chairs for relaxation while riding—and—but fill in your own, if you were there, and imagine, if you weren't.

* * *

As indicated in my July column, some members of the A.H.O.S.R.O. also commented on the convention and I held those comments over until this month. I suspect that Bert Berry may have had a hand in writing the following:

"Recollections of Atlantic City:—A board walk that was mostly in the 'rainy season'—shore dinners that really 'crawled' with lobsters—a long receiving line at the presidents' reception dance, that included the present day 'greats' of the A.W.W.A.—the

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SAVINGS UP TO 80% - 85% NOT UNCOMMON

HYDRAUGER operation SAVES TIME and lots of it! With man-hour costs HIGH, it is wise ECONOMY to equip your crews with TIME SLASHING HYDRAUGERS.

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The powerful air-driven HYDRAUGER machines (3.2 and 5.2 horsepower) bore and ream any size open hole from 2 in. through 14½ in. The Hydrauger bore is straight and ready for easy installation. Bores of over 200 feet have been made in one operation; makes 8½ in. hole at 40 feet per hour in ordinary soil conditions; 2½ in. hole through rotten rock at 50 feet per hour.

OPEN HOLE

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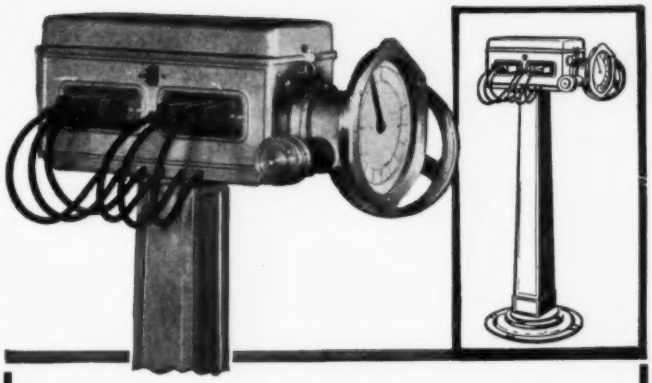
HY-13a

EARTH BORING TOOL



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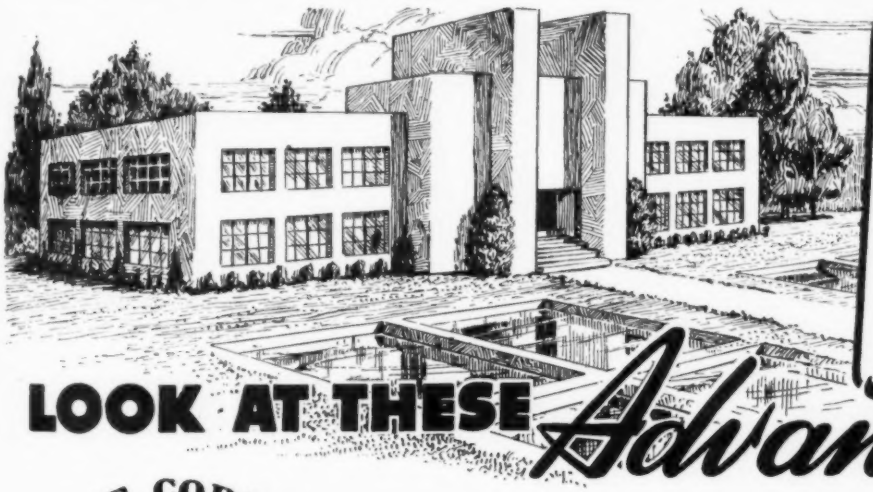

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Coagulation is effective over a much wider pH range than with other coagulants. Color flocs may be formed in the very acid range. On the other hand, true hydrated ferric oxide flocs may be formed at pH 9-10, or even higher, for the removal of turbidity and manganese.

The time required for floc formation, conditioning, and settling is in most cases considerably shorter than that required for other coagulants.

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Ferric floc does not seem to stick to sand grains to form mud balls, and is subject to less "breaking through" on the filters.

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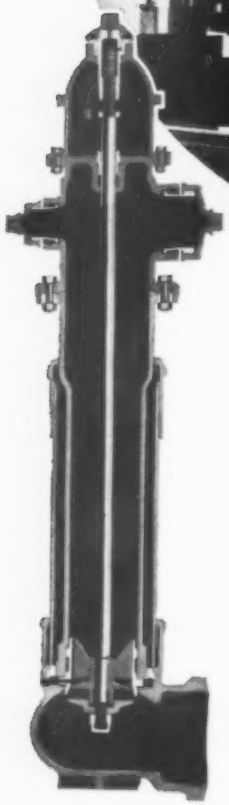

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many convivial fellowships revived by the annual meeting and by supplementary aids—an auditorium packed with wonderful displays of water works products—and finally, deep concentration in the technical sessions. —'From Innocents Abroad.'

"We take our hats off to the 'circle of charm' encountered at these A.W.W.A. meetings. The presidents (past, present, and future) set an example that would convince even the most skeptic. Conspicuous at Atlantic City in this category were the Tom Veatch's, the Lou Howson's, the Abel Wolman's, the Sam Newkirk's, the Norman Howard's, the Wendell La Due's, the Leonard Thompson's, the Linn Enslow's, and the A. P. Black's, and on down the line to mention only a few. These personal qualities, so outstanding in the husbands, have reached the superlative in their ladies."—Hmmmm, it looks as though some one else besides "Doc" Symons can appreciate beauty, too.

* * *

Among my memories is the session, when Robert Millar of Wichita, Kas., introduced Abel Wolman as an outstanding "character" in A.W.W.A.; whereupon, Abel began his talk by saying, "This character is here today, to tell you etc., etc., etc."—I shouldn't say this I suppose, but I actually don't like to report a meeting at which Abel talks; you see I get so damn interested in listening to him that I forget to take notes.—And if you think that he isn't a dynamic speaker, draw up a chair, and listen to this story—

In the meeting rooms, the convention hall provides a loud speaker system with an operator to twist the dials of the control mechanism. There, in the corner of the room sits that man, drawing union wages, occasionally touching the control knob, when the speaker's voice becomes loud enough

(Cont. on page 76A)

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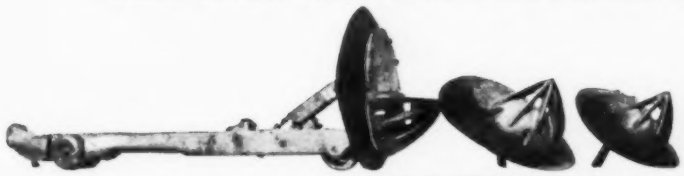

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1947
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For Sale

Because the 1948 Reference & Data number was published nine months after the 1947 issue we had a number of the 1947 books remaining in our files.

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To save billing charges send your money with order. If you or any of your friends would like this valuable back number send your order at once while copy is available.

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A new photoelectric instrument of high accuracy for the measurement of color and turbidity, as well as for all analytical colorimetric tests in the examination of water and sewage.

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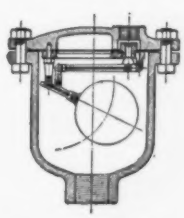


No. 200 VALVE

VALVE AND PRIMER CORPORATION 30 W. Washington St., Chicago 2, Ill.

to intrude on his reading of some pocket magazine.—Well, this particular day, the man in the corner had been engrossed in the current issue of Readers' Digest through seven speeches (mostly long), when Abel Wolman stepped to the rostrum and began, "This character, etc., etc."—No! The man in the corner didn't even look up, but—within three minutes while Abel was still speaking without so much as a glance at a note, he, the man in the corner, closed his book, laid it on the control box, and joined the audience in giving his rapt attention to the man on the platform.

The good book says, "Thou shalt not be envious," but Abel Wolman is one man whom I envy for his wonderful vocabulary and his oral use of it.

* * *

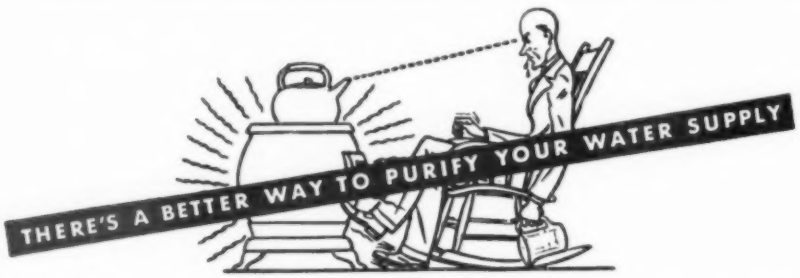
Things I Learned At The Convention—That Lou (Indianapolis Water Co.) Finch and S. T. (Springfield, Ill. Water Dept.) Anderson were roommates at college—That Dick Hazen (of Malcolm Pirnie's office), Owen (Calgon) Rice, and George (Denver Water Comm.) Turre, among others, are excellent ballet dancers and stage performers—That Jimmy **(W. & S.W.)** Angell was called "Jolly" Angell back in Carbondale, Ill.—That Mrs. Cliff Fore (he's the new A.W.W.A. Director from the Ill. Sect.) is one of my regular readers—That there is a creek in south New Jersey, named Loveland Thorofare (hmmm-m-m!)—and that Jim (W & T) Kinney from Toronto and Otto (Kansas City) Reynolds were roommates at Syracuse University in 1923. Here's how they looked a quarter of a century after graduation.

* * *

And speaking of charm, it was really in evidence at the annual dance; from the amount of cutting in on the dance floor, there were a lot of other fellows besides me who thought I was squiring a very pretty girl in a white evening dress. "Bob" Wilson, of our Chicago office likewise found his Doris to be quite in demand as did numerous other husbands. Fifteen-year-old Betty Payne, from Louisville, Ky. (her dad is Supt. of Water there), was a much sought after dancing partner throughout the evening. I unlimbered my camera on her, but ruined the shot—Sorry, Betty—I did get a couple of good shots, however, as for example: Marion (Mrs. Victor) Weir of St. Louis, Dot (Mrs. Casey) Jones of Philadelphia, and Libby (Mrs. J. P.) Orr of Memphis, Tenn., all of whom appear here—

* * *

It's a Small World—No. 5.—I was standing in our booth on the exhibit floor when up comes a fellow who says, "I'm Frank Abbott from Danville, Ill., and I'm the receiver of the Westville, Ill., Water Co. My wife wanted me to look you up, she was Lucille Bredehoft."—Well, what d'y'know—I used to date her sister when I was in high school.—Westville buys its water from the water works in Danville, and both Frank and Tony



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Even if the watched kettle never boils you can have safe, pure water with %Proportioneers% Heavy Duty Chem-O-Feeder. This inexpensive, dependable chemical feeder will automatically purify up to a million gallons of water a day. Cross-connected to the starting switch of the main pump motor, the Chem-O-Feeder operates exactly in step with the pump and sterilizes every drop of water. It feeds just the right amount of hypochlorite or other chemical — eliminates the unpleasant taste resulting from overfeeding, and prevents dangerous undertreatment. Write for Bulletin SAN-2.

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Slazas, Westville's Supt., knew my dad when he ran the water plant in Danville. It's been all of a couple of days (or decades) since I had seen Lucille, but she's lost none of her charm, and it was like old home week when we all got together for breakfast one morning.

* * *

Last year at the S.F. Convention, several of the girls complained that there were too many events scheduled for Thursday, the day of the annual banquet. In response to their requests, I mentioned their complaints in one of my columns. This year, when the ladies events scheduled for Thursday consisted only of the much postponed rolling chair ride and the banquet, those same girls thanked me, but I strongly suspect, kiddies, that one H. E. Jordan had more to do with the arrangements than did my column.

* * *

Well, well, here I am again, out of space and I haven't wound up the Atlantic City convention yet. If you don't mind, I've a few more little items that I'll carry over until next month—See you then, after a vacation (I hope)—V. T. Y.—Doc.

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TESTED FOR OVER 30 YEARS

For more than thirty years water works superintendents have been using Hydro-tite for joining bell and spigot pipe. They have found that this self-caulking, self-sealing compound costs less to buy, requires less labor, makes tighter joints and withstands the effects of time, strain and vibration. Send for data book and sample.

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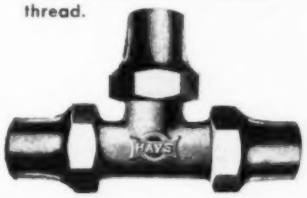
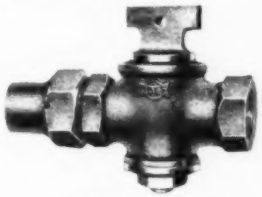
All HAYS water works fittings are interchangeable with those of other manufacturers and corporation stops can be installed with any standard tapping machine equipment. They are made of highest quality 85-5-5-5 bronze, plugs are ground for perfect fit, specially lubricated for permanent easy turning, and hydrostatically tested at 200 pounds or more. Write for the new HAYS catalog showing the complete HAYS line of water works products.



CATALOG No. 5622
Hays Tee for copper to copper to copper connection.



CATALOG No. 5050
Hays Curb Stop for iron pipe to copper service connection.

CATALOG No. 5626
Hays Elbow for copper to copper connection.

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Hays Two Part Union for copper to copper connection.

CATALOG No. 5605
Hays Coupling for Male iron pipe to copper connection.

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[Overflow from the main section]

Pennsylvania Rivers to Be Free from Coal

Pennsylvania Rivers, particularly the Schuylkill which has long had an unsavory reputation as a carrier of silt from anthracite coal operations, are to be freed of coal as result of the work of the clean streams program of Pennsylvania. The extent of the accomplishments in preventing mine refuse from entering the River is shown by the estimate that by July 1 the flow of silt from all coal operations on the Schuylkill watershed will be reduced to a rate of 25,000 tons annually. Considering that the estimated load formerly on the river was two million tons annually, this is a tremendous reduction.

There are 63 coal operations from which silt can be discharged to the Schuylkill and its tributaries; of that number 29, including most of the larger operations, have desilting works in operation, 13 have systems under construction, and six are under orders to construct desilting works, while 15 have discontinued operations.

When these desilting works are all in operation, the Department of Forests and Waters of the State of Pennsylvania will undertake to dredge from the waterways the silt which has accumulated over many years.

Ohio River Compact Now in Motion

Formal signing of the Ohio River Compact was carried out amid colorful surroundings and appropriate ceremony June 30 in the luxurious Netherland Plaza's Hall of Mirrors in Cincinnati, setting off actual operation of the gigantic stream pollution project affecting 25,000,000 people and 200,000 square miles of territory in eight states comprising the Ohio River watershed.

Seven governors and a representative of New York's Gov. Thomas E. Dewey and their assistants signed the 20 copies of the agreement.

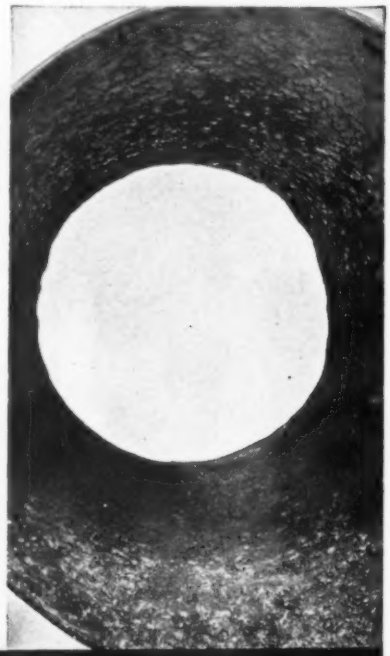
In a telegram to the meeting, President Harry S. Truman announced his signing of the Barkley-Taft antistream pollution bill which carries a five-year appropriation of $122,500,000 and provides for an enlarged stream sanitation laboratory and staff of the U. S. Public Health Service in Cincinnati, Ohio. He said: "The governors may be assured that the federal government will do its part in cooperating in control of water pollution."

Gov. Dewey wired that he regarded the compact as "One of the signal developments in the field of interstate cooperation. It demonstrates that although the process may sometimes be slower, cooperation between states can soundly solve many of the problems facing our country without establishing agencies dominated by distant government."

Gov. Ralph F. Gates, Indiana, was the first to sign the compact, as representative of the first state to ratify the agreement in 1939, nine years after agitation for its formation was begun. The signatories, in the order signed, are: Gov. Gates; Gov. Clarence W. Meadows, West Virginia; Gov. Thomas J. Herbert, Ohio; Dr. H. E. Hilleboe, state health commissioner for New York; Gov. Dwight Green, Illinois; Gov. Earle Clemments, Kentucky; Gov. James Duff, Pennsylvania, and Gov. William M. Tuck, Virginia.

With seven miles of badly corroded 36" and 48" steel pipe up for replacement at an estimated cost of $1,800,000., the City of Montreal reconditioned the entire line at a total cost of only $205,000. — a saving of $1,595,000.

Reconditioning included a thorough cleaning and removal of incrustation and debris by the National Water Main Cleaning Co. after which the cleaned surface was centrilined. Final results indicate reduced friction losses, improved carrying capacity and permanent protection against leakage and internal corrosion.



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SAVES MONTREAL $1,595,000

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The next step in operation of the compact will be enactment by Ohio and the other signatory states of legislation making it unlawful for any municipality or industry to discharge raw, untreated sewage or industrial waste into any public waters.

In this connection, Gov. Herbert of Ohio announced that 180 of that state's cities are proceeding now with plans for sewage treatment and disposal systems, including the $25,000,000 Cincinnati sewage disposal project.

Gov. Duff of Pennsylvania announced that the city of Pittsburgh is planning a $100,000,000 sewage treatment and disposal system.

Commission to Have Power to Issue Orders

The Ohio River Valley Sanitation Compact sets up a sanitation district in the Ohio River watershed and creates a commission of three members from each state and three from government agencies to meet on call of a chairman elected from the committee membership, and permits appropriations from each state for use by the commission to draft plans of interstate magnitude for stopping pollution of streams from any cause in the entire watershed of the Ohio River *and all of its tributaries.*

The compact authorizes the commission to work with separate state or local bodies on specific projects or problems related to the prevention of the pollution of public streams. It provides for commission collection of data to aid in sewage treatment and industrial waste treatment, and provides that the commission shall meet more than 30 days before scheduled regular meetings of the various state legislatures and send recommendations to the governors of the compact states on needed action in the particular state or states to clean up unsanitary conditions exisiting in streams.

The commission also is empowered to issue orders to any municipality, corporation or person, or any other entity discharging waste into streams of a district to cease such pollution and shall specify a date when such pollution shall cease.

However, the commission is without power to provide funds to carry out the work it orders. These funds must be provided in part or wholly by the persons or units named in the orders. Funds voted by each state of the compact for carrying on its work are to be prorated by ratio of population and area to the entire area of the district.

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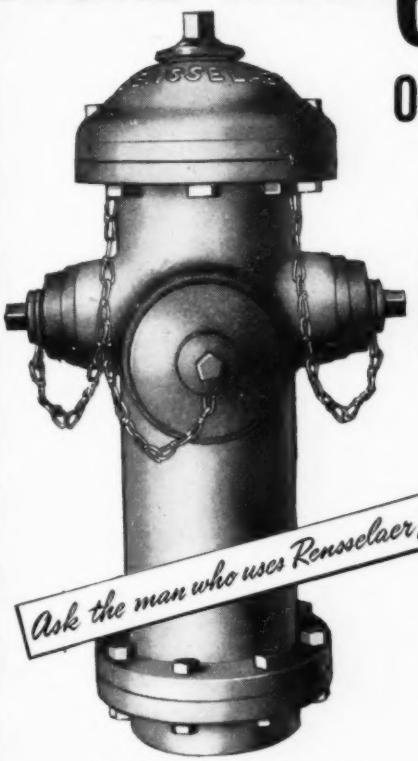

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Cincinnati Made Permanent Headquarters and Commission Named

Cincinnati was made permanent headquarters of the Ohio River Valley Sanitation Compact at the first meeting of the group July 1, following the signing ceremonies June 30.

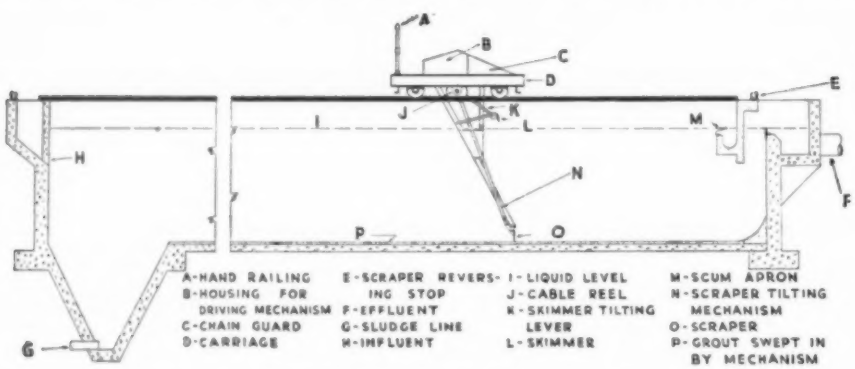
Hudson Biery, chairman of the Ohio commission, was named general chairman. Joseph L. Quinn, Terre Haute, Ind., chief engineer, Hulman Co., was named vice-chairman, and F. H. Waring, Columbus, O., chief engineer, Ohio Department of Health, was elected secretary.

An eleven member executive committee was elected, comprising the three top officials (Biery, Quinn and Waring) and the following: Blucher A. Poole, chief sanitary engineer, Indiana State Board of Health; Kenneth S. Watson, engineer, W. Va. Water Comm., Charleston, W.Va.; Kenneth M. Lloyd, executive secretary, Mahoning Valley Industrial Council, Inc., Youngstown, O.; Clarence M. Klassen, chief sanitary engineer, Illinois Department of Public Health; Martin F. Hilfinger, president, Associated Industries of New York State, Inc., Buffalo; Henry Ward, Kentucky commissioner of conservation; Dean E. A. Holbrook, University of Pittsburgh School of Engineering, and E. Blackburn Moore, chairman, Water Control Board of Virginia, Berryville, Va.

A temporary fund of $20,000 was established by the commission to cover seven months of organizational work. —*Don Wimmer.*

Conserve Space with . . .

HARDINGE RECTANGULAR CLARIFIERS



In sewage or water treatment plants where space is limited, or where sludge delivery is desired at one end of the tank—the Hardinge Rectangular Clarifier provides a compact, efficient unit.

A traveling bridge crane spans the tank and supports a sludge scraper. This mechanism moves automatically along the tank, scraping all settled solids into sludge hoppers at one end.

Write for Bulletin 35-C which describes the complete line of Hardinge Sanitation Equipment

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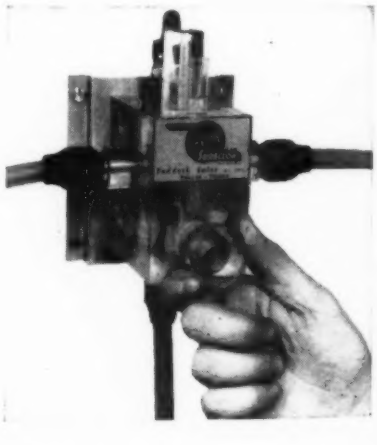
MANUFACTURERS' and EQUIPMENT NEWS

800

Automatic Water Chlorinating Unit

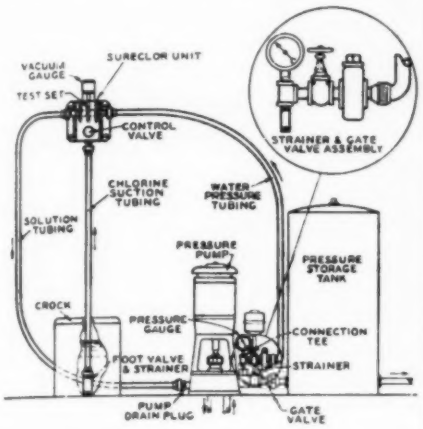
Paddock Sales of Texas, 3727 Atwell St., Dallas, Texas, has developed a small automatic water chlorinating unit known as Sureclor. The Sureclor unit which is shown in the accompanying photograph provides a simple method of adding chlorine solution to a stream of water. It is easy to install and simple in operation, being automatically operated by water pressure.



It requires no maintenance because there are no motors or pumps and it gives dependable service according to the manufacturers.

In the accompanying diagram the arrangement for installation of the unit is shown. The unit chlorinates water by use of any hypochloride solution. Directions for the installation of the unit, for operation and for testing the chlorination are given in the folder issued by the company.

These units are designed to produce safe drinking water for ranches, farms, hunting lodges, fishing camps, country homes, summer camps, and temporary construction camps. The unit undoubtedly could also be used for chlorinating mains during



sterilization or for temporary chlorination of water supplies where breaks or possible contamination exist.

For further information on this unique unit fill in a Reader Service Card with the above key number and mail to this magazine.

G. W. Smith President De Laval

De Laval Steam Turbine Co., has announced the retirement of H. L. Watson as president after 35 years of

active service and the election of George W. Smith, Jr. as his successor. Mr. Watson will continue to be part of the company's management in the capacities of a director and chairman of the executive committee. George C. Stoddard is Chairman of the Board of Directors.

Mr. Smith joined the De Laval Co. in 1947 as assistant to the president. He has previously been vice president and director of the White Motor Company, works manager Victor Talking Machine, chief engineer of Naval Aircraft plant at Philadelphia. More recently Mr. Smith has been engaged in industrial engineering consulting services as the senior member of the New York firm of Smith and Wood, Inc.

Announcing New

FLEXICHROME
STEEL SEWER ROD

EXCEPTIONAL STRENGTH

EXCEPTIONAL RESISTANCE TO BREAKAGE & KINKING

FLEXIBLE'S new "Flexichrome" Steel Sewer Rod is the result of four years of research by one of America's largest steel mills. Developed exclusively for Flexible, it will last three times as long as any other metal obtainable today.

SEE YOUR FLEXIBLE JOBBER TODAY FOR FULL DETAILS ON THIS IMPORTANT TOOL ANNOUNCEMENT

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STEAM AND WATER TYPES
FOR DIGESTER HEATING

American Radiator & Standard Sanitary Corporation, Pittsburgh, Pa.

SALES OFFICES IN PRINCIPAL CITIES

FOR RATINGS AND DATA SEE OUR PAGE IN THE ANNUAL REFERENCE SECTION

AMERICAN-Standard
First in Heating and Plumbing

Besselievre Heads Dorr's Foreign Sanitary Activities

Edmund B. Besselievre, who has spent 13 of his 27 years with the Dorr Co. as its South American representative, has been appointed in charge of all sanitary engineering work of that company's Foreign Division, with headquarters for the present in New York.

During the past year Mr. Besselievre has been on a personally requested leave of absence during which time he was in Argentina as Sanitary Engineering Advisor to the North American Technical Commission, under contract to the Argentine Government, to advise on various phases of General Peron's Five Year Plan.

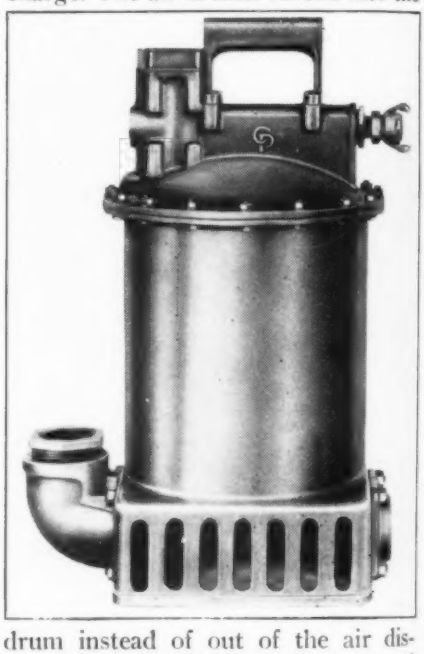
Anderson Promoted At Worthington

Worthington Pump and Machinery Corp. has announced the appointment of Harold T. Anderson, as assistant to the General Sales Manager, in charge of Sales Production Relations, with headquarters at Harrison, New Jersey. A graduate of Stevens Institute of Technology, Mr. Anderson has been employed by Worthington since 1924. In his new capacity he will be responsible for receiving and interviewing representatives and customers' organizations, who visit the Harrison Works seeking current information with respect to production schedules of specific orders. It is expected by the company that this newly created office will provide a smoother channel for expediting, and will advance the overall customer-relations programs.

801

Air-Operated Sludge Pump

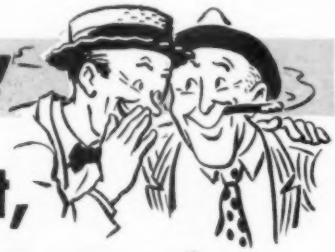
Chicago Pneumatic Tool Co., Chicago, Ill., has developed a portable air-operated sludge pump, known as Type No. 7. This air-operated sludge pump works on the ejector principle. Compressed air flows through the air inlet, creating a vacuum which sucks water through the inlet until the float valve in the drum shuts off the air discharge. The air is then forced into the



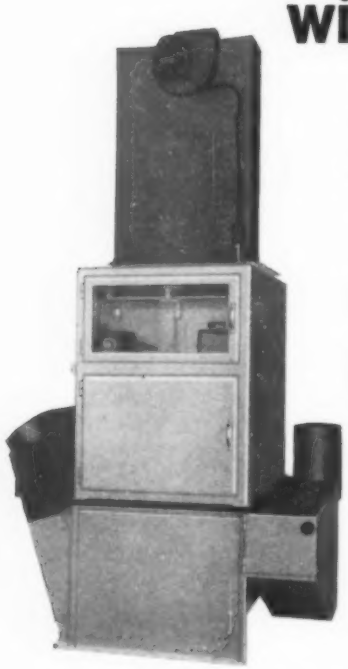
drum instead of out of the air discharge, and the pressure thus created forces the water out of the water discharge. This gives a pulsating flow much the same as a hand-pump.

The unit has a high lift capacity; and low air consumption. It will handle 15 per cent of solids and water containing sand or rock drill cuttings without causing rapid wear of expensive replacement parts. The unit has applications in mine shafts, coffer dams, caissons, sumps, pits, sewers, construction jobs, and many other places. At 50 foot head it has capacity of 65 gpm. and at 200 foot head it has a capacity of 20 gpm. The unit has found successful use in water filtration plants in removing solids from pumps, sumps, inlet wells, and so forth.

KEEP IT CLEAN!



for a Clean Plant, install OMEGA Feeders with Dust Collectors



The Omega Loss-in-Weight Gravimetric Feeder and Lime Slaker

Hopper filling and chemical feeding are dust-free operations once you install OMEGA feeders with OMEGA Dust Collectors. Dust is separated from the air as it is drawn through the fine mesh filter bags and — instead of being wasted — the collected chemical is dropped back into the feeder. This stops the dust nuisance at its source, saves many hours of needless maintenance, and greatly simplifies plant housekeeping. The blower is on the suction side and handles only filtered air.

The OMEGA Loss-In-Weight Gravimetric Feeder and Lime Slaker, shown with Dust Collector mounted on feeder hopper, is a combination famous for accuracy, dependability, and cleanliness. It weighs, feeds, and records within 1% by weight; available in sizes to feed ½ to 5,000 lbs. per hour.

Specify OMEGA Dust Collectors with your orders for OMEGA feeders.

Write for Bulletins

OMEGA PRODUCTS

Volumetric Feeders • Gravimetric Feeders • Solution Feeders
Lime Slaking Equipment • Bucket Elevators • Laboratory Stirrers

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WEEDS are OUT at water works installations

DOLGE SS WEED KILLER

can be used to advantage in all areas containing water works installations, where no vegetation whatever is desired. Sprinkled on, in economical dilution, this formula works down to the roots, so that it destroys not only surface growth but the entire vegetable structure . . . particularly important where stand pipe locations must be considered. Keeps the growth down around high reservoirs; with proper application there is no danger that the solution will work into storage facilities.

E. W. T. Selective Weed-Killer

(2-4-D) maintains your landscaping but eliminates noxious weeds. Non-injurious to most grasses, E.W.T. aids in keeping a "well-groomed" appearance to the grounds around your pumping plant, purification plant, storage facilities and administration building.

Both DOLGE WEED KILLER and E. W. T. SELECTIVE WEED KILLER have their place in your ground maintenance program. They forestall hours of expensive labor devoted to weeding by "going to the root" of the weed problem.

GET ALL THE FACTS!

Write for DOLGE'S brand-new booklet

"CHEMICAL WEED CONTROL"

—Contains complete, up-to-the-minute information on how to deal with your weed problems swiftly, economically and *lastingly*.

The C. B. DOLGE CO.
WESTPORT, CONNECTICUT

For further information enter the above key number on a Reader Service Card and mail to this magazine.

Litsey Represents De Laval in Chicago

De Laval Steam Turbine Co. of Trenton, N. J., has announced the appointment of L. D. Litsey as the representative of the company for the

Chicago area. Mr. Litsey will handle worm gear reducers for them at the headquarters of his own company, the Litsey Equipment Co., 6459 North Sheridan Road, Chicago 26. Other De Laval products will continue to be handled by the Chicago District office of the De Laval Steam Turbine Co., Peoples Gas Building, Chicago 3, Ill.

WRITE FOR THIS BULLETIN

FOR pH Control and WATER TESTS

A study of our 28-page Bulletin No. 602, containing the complete line of Hellige apparatus for pH control and water analysis, will enable you to form an intelligent opinion as to what is best suited for extending your present equipment or for an initial installation.

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3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
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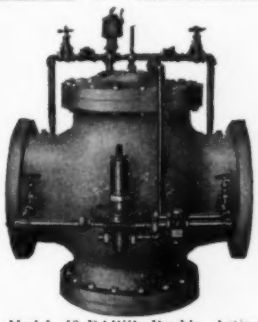
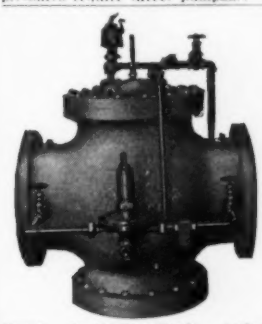
ROSS AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

ROSS VALVE MFG. CO.
Incorporated
P.O. BOX 595, TROY, N.Y.

Kalinske Promoted At Infilco

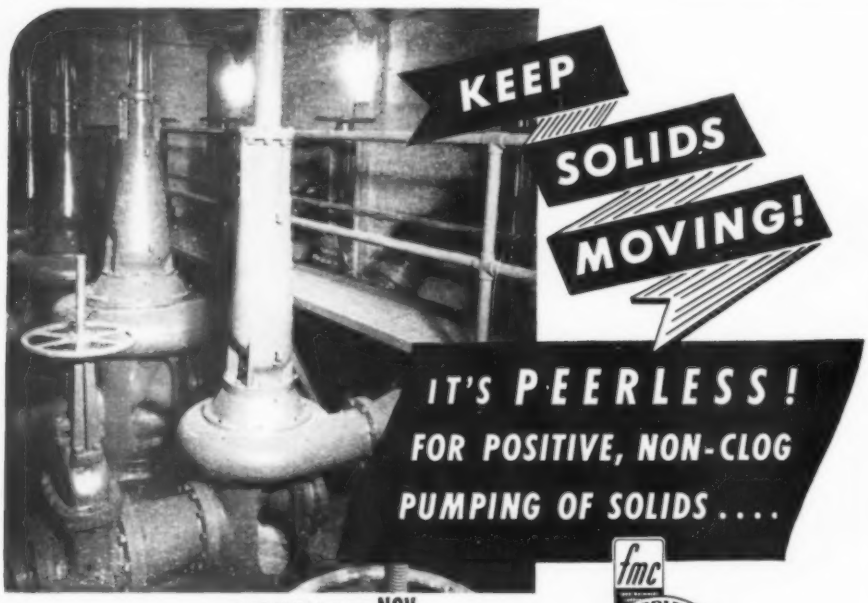
A. A. Kalinske, formerly Chief Hydraulic Engineer for Infilco Inc., Chicago, has been promoted to the position of Director of Development, according to an announcement by P. N. Engel, Infilco president. In his new position Mr. Kalinske will direct all development activities for the company including hydraulic, mechanical and electrical research laboratories.

Prior to his association with Infilco in 1946, Mr. Kalinske was special consultant for the Navy's David Taylor Model Basin in Washington, D. C., and Associate Professor of Hydraulics at the University of Iowa. He supervised several research projects of the Iowa Institute of Hydraulic Research for the National Defense Research Committee. Mr. Kalinske was recently awarded the Karl Emil Hilgard prize in hydraulics by the Hydraulics Division of the American Society of Civil Engineers.

Diamond Alkali Obtains Loan

The Diamond Alkali Company has arranged to borrow $10,000,000 from the Metropolitan Life Insurance Company on twenty-year 3 per cent notes. The First Boston Corporation acted as agent in the transaction.

The loan will enable the company to round out a $30,000,000 program of plant expansion and production development.



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Horizontal & Vertical Type Non-Clog Pumps for Dry Basin Installation

CAPACITIES: *Up to 7000 GPM* HEADS: *Up to 70 ft.*

Non-Clogging in Action as well as in Name Through Peerless' Exclusive Impeller Design

The heart of this pump is the impeller. The two-port Peerless impeller, shown at right, has unique repelling vanes on both the outer shrouds, and scientifically designed working vanes of uniform thickness to keep solids moving. Peerless Non-Clog Sewage Pumps offer a modern and dependable means of pumping entrained solids in sewage disposal service, paper mills, canneries and packing plants, process industries, and for lift stations, railroad underpass applications, etc.

No rings to clog—no seals to bind! Unique repelling vanes on both outer shrouds keep solids clear at casing side walls.

TYPE NCH... HORIZONTAL NON-CLOG TYPE

By eliminating all wearing rings, end plates, filler rings, etc. and minimizing recirculation losses, the advanced design principle of the Peerless Sewage Pump is the ideal choice for maximum clog-free pumping service with down time at a minimum.

Request your copy of the new Non-Clog Sewage Pump Bulletin No. B-154 and compare the many Peerless advantages and improvements.

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
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District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California

LITERATURE AND CATALOGS

802

SAFETY RULES

The Clay Sewer Pipe Association, Columbus, Ohio, has developed a list of 15 sensible, but often overlooked, safety rules for unloading railroad boxcars. The list concerns itself principally with the unloading of vitrified clap pipe, but is readily adaptable to the unloading of any heavy object or material. These safety rules are printed on a single side of an 8½ x 11 inch sheet which could be fixed to bulletin boards or attached to walls of receiving departments. Four basic rules concern personal safety, and 11 rules are concerned with the care of the material.

If you desire a copy of this list of safety rules enter the above key number on a Reader Service Card and mail.

803

PUBLIC RELATIONS AID

C.I.P. Res. Assn. Issues Unique Booklet

The Cast Iron Pipe Research Assn. is continuing its program of acquainting the public with the facts about the water works industry. Latest item in its program is the issuance of a booklet titled **"Creating Favorable Public Opinion for Water Supply Systems."**

The booklet was mailed in August to some 20,000 water works superintendents, mayors, city managers, consulting engineers, etc. It presents

dramatic facts about public water supply and contains cartoon illustrations and suggestions for the preparation of speeches, newspaper publicity, or advertisements connected with local public relations programs.

According to the C.I.P. Res. Assn. the sole purpose of the booklet is to stimulate local education publicity in cooperation with the public relations program of the A.W.W.A. If you didn't receive a copy enter the above key number on a Reader Service Card and mail.

804

FLOCCULATION EQUIPMENT

Chain Belt Co. of Milwaukee has issued Bulletin No. 48-39 on **Rex Flocculation Equipment.**

This new bulletin describes the equipment for pre-treatment of water in chemical mixing. It gives complete and detailed information about the Rex Floctrol, Rex Slo-mixers and Rex Flash-mixers. Information on features of construction, design and arrangement of installation, and diagrams for installation are included.

A copy of this interesting bulletin may be obtained by entering the above key number on a Reader Service Card and mailing same to this magazine.

Safe Descaling of Meter Parts

YOU get fast, safe descaling when meter parts are immersed in solution of Oakite Compound No. 32, inhibited acid descalant. This easy-to-control material dissolves lime-scale and rust completely . . . without attacking underlying metal. Write for 28-page booklet TODAY. No obligation.

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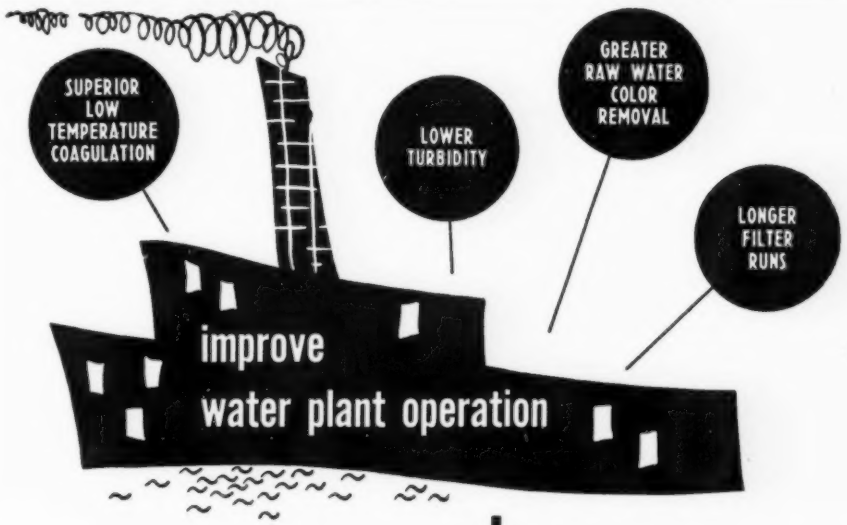
The pictures tell the story. A 6-months old concrete pipe sewer line at Owen Sound, Ontario, was found to be failing under earth load. The tests shown above were made, and convinced the city officials that a reinforced "GUNITE" lining would correct the trouble, and we did the job in 1934. The sewer was 36" and 48" diameters and one-half mile long. "GUNITE" is ideal for lining and strengthening old brick or concrete sewers and has been widely used for this purpose.

Our 72-page bulletin C2300 describes scores of profitable uses of "GUNITE." Write for your free copy.



Want any of these for your plant? Let us send you a sample of "N" Silicate with directions for activating by any of the processes listed below. Jar tests prove how N-Sol forms large, tough, heavy floc to aid coagulation.

N-SOL PROCESSES FOR WATER COAGULATION

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N-Sol-A* — N Silicate reacted with ammonium sulfate. Used where chloramine sterilization is desired.

N-Sol-B — N Silicate reacted with alum. (U. S. Pat. 2310009)

N-Sol-C* — N Silicate reacted with Chlorine. The residual hypochlorite retains the same oxidizing powers produced by normal chlorine sterilization.

Baylis Sol — N Silicate reacted with sulphuric acid. (U. S. Pat. 2217466)

N-Sol-D — N Silicate reacted with sodium bicarbonate.

* Patent Applied For.

805
PHOTOELECTRIC COLORIMETER

Photovolt Corporation, 95 Madison Ave., New York 16, N.Y., has a bulletin on the **Lumetron Photoelectric Colorimeter Model 450 for Nessler Tubes.**

The bulletin contains a discussion of the application and operating principles as well as a description of the apparatus, and describes its operation for determination of turbidity and color, ammonia nitrogen, organic and nitrate nitrogen, nitrite nitrogen, etc.

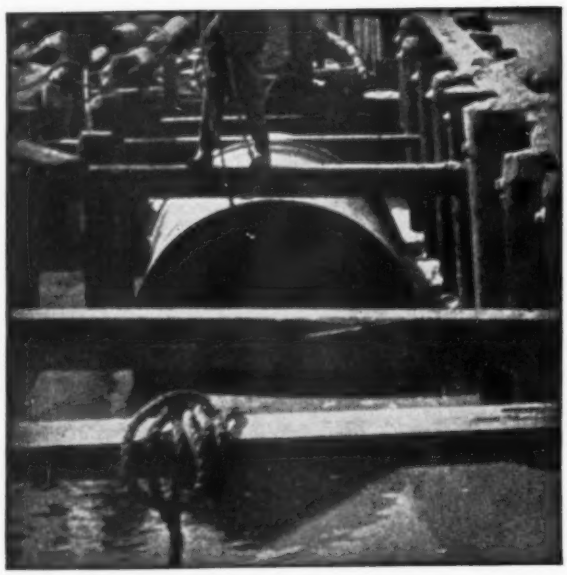
A copy of this bulletin is obtainable. If you desire one, enter your name and the above key number on a Reader Service Card.

806
SUBMERSIBLE PUMPS

The Pump Division of the Byron Jackson Co. of Los Angeles, Calif., has published a 4-page bulletin No. 48-5250, on **Lake and River Intake Submersible Pumps.**

The bulletin shows diagrams for the installation of these pumps and pictures of the pumps, which consist of close-coupled pump and motor. The motor is oil-filled and sealed for underwater operation.

To obtain a copy of this catalog, enter the above key number on a Reader Service Card and mail.



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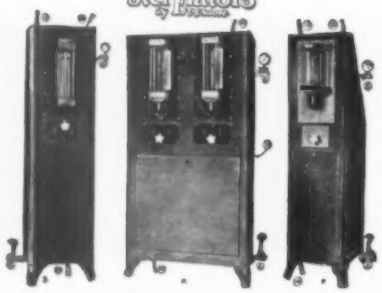
SterElators by Everson



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Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

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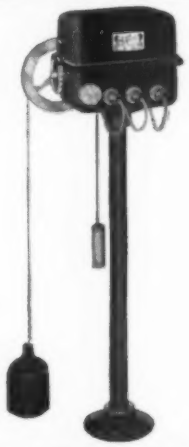

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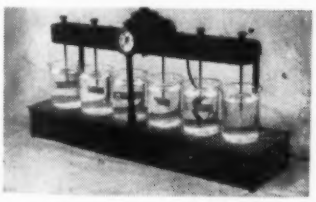

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LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

807

ACTIVATED ALUM AND BLACK ALUM

Stuart Corp. of 516 N. Charles Street, Baltimore 1, Md., has published a handy size 10 page bulletin on "The Technical Story of Standard Activated Alum and Black Alum". This Technical Publication No. 48, explains these coagulants for use in the water works, paper mill, and sewage treatment fields.

The bulletin explains what Black Alum is, and gives its composition on a data sheet and the advantages of its use.

Filter plant superintendents and operators will be interested in this bulletin on these coagulants for use in water purification. A copy can be obtained by entering the above key number on a Reader Service Card.

808

ROTAMETERS

Brooks Rotameter Co., Lansdale, Pa., has issued a full catalog covering its line of rotameters for flow measurement and control.

This catalog includes the "Full-View" rotameter with safety shielding for normal pressures and temperatures, the "Stain-Met" Armored rotameter for high pressures and temperatures, and the "Inductronic" rotameter for remote record, automatic control, or totalization of flow rates.

Also described is the new "Sho-Rate" rotameter for purge systems, and the "Multi-Range" Flow Rate Kit for research laboratories and pilot plants. The bulletin also contains a capacity chart, data sheet, and dimension prints of each type of meter.

To obtain a copy of this booklet on these flow measurement devices, mail a Reader Service Card containing the above key number.

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A dependable self-caulking joint compound for cast iron bell and spigot water mains.

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of stainless steel with new bronze thrust roller.

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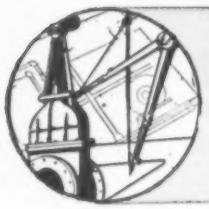

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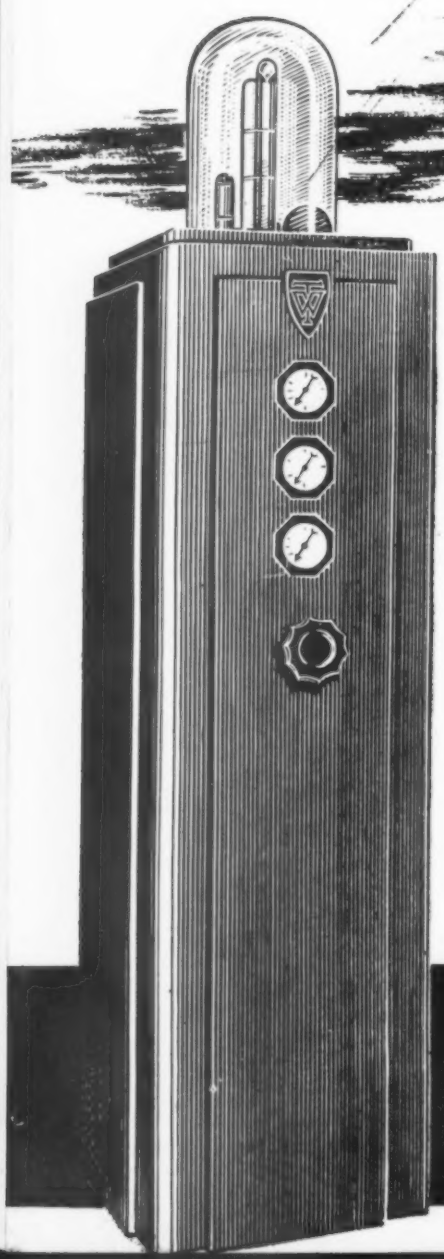

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